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The Development of the RAN Research Laboratory

W.F. Hunter, Editor

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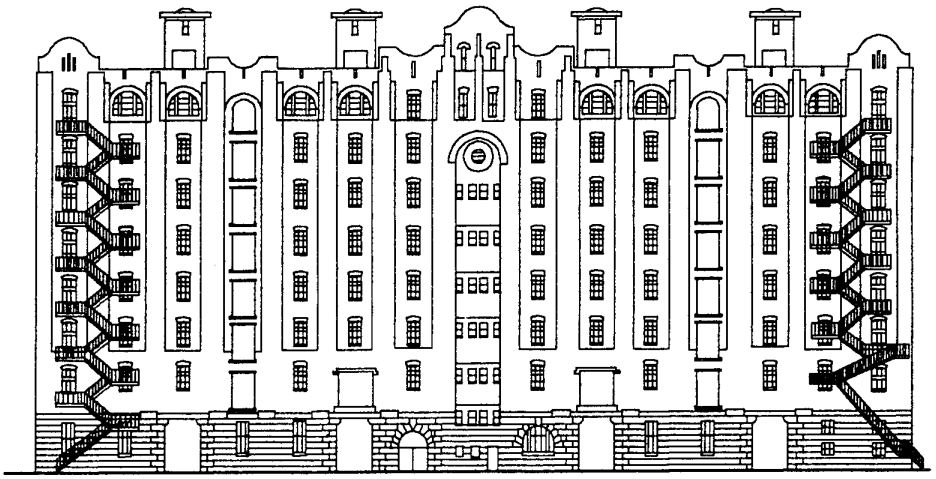

Maritime Operations Division
Aeronautical and Maritime Research Laboratory

DSTO-GD-0078

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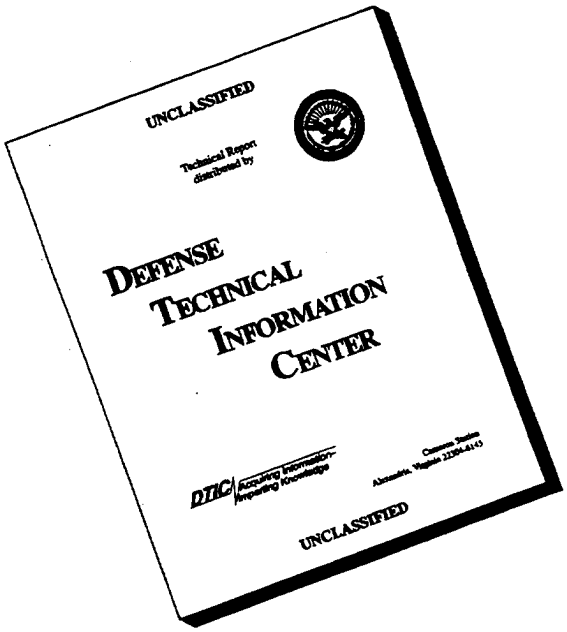

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Cover Illustration : Building 3 at REVY, RANRL's site since 1984.

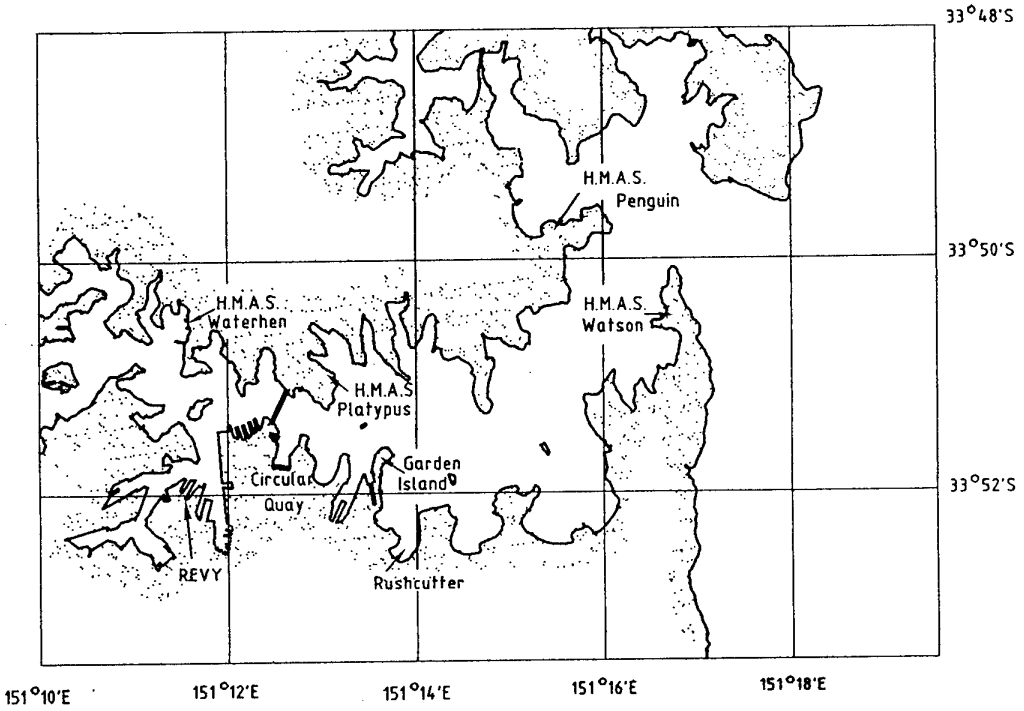
The Development of the RAN Research Laboratory

Executive Summary (U)

This monograph records the history of the RAN Research Laboratory, which was established in 1956 as the RAN Experimental Laboratory on the shores of Rushcutters Bay in Port Jackson, NSW. This site has a long history of association with the Royal Australian Navy.

Founded in a period when British influence was strong in Australia, the laboratory drew its early culture from the Admiralty. During the period of this chronology the USA came to dominate defence technology and provided the western role model for this area of endeavour. The laboratory's links with US Navy increased during its history but the laboratory evolved its own Australian character.

A description of the laboratory's relocation in 1984 to the Royal Edward Victualling Yard in the Sydney suburb of Pyrmont, and the subsequent subsumption, in 1987, of RANRL by the Weapons Systems Research Laboratory completes the story.



Port Jackson, NSW, Australia

CONTENTS

A WHIMSICAL VIEW OF EARLY RANRL

THE RAN EXPERIMENTAL LABORATORY 1956 - 1969

APPOINTMENT OF A SCIENTIFIC ADVISER

The origins of the laboratory can be traced to a visit to Australia by Dr W.J. Cook, the Chief Scientist of the British Royal Naval Scientific Service (RNSS). Dr Cook arrived in Melbourne on 5th March 1954, and had discussions at Navy Office which led to the recommendation by the Deputy Chief of Naval Staff that a scientist be appointed as Scientific Adviser to the Naval Board.

The Naval Board discussed the recommendation in consultation with the Department of Defence Scientific Adviser. Agreement was reached regarding the necessity to appoint a Scientific Adviser to the Naval Board (SANB) and a proposal that the RAN should undertake operational research was also supported. Ministerial approval for these arrangements was obtained on 9th June, 1954.

Consequently the British Admiralty was approached and asked to supply, on loan for three years, a senior member of the RNSS who was conversant with current research problems. The duties he was required to perform were:

(a) to advise the Naval Board on matters relating to the development of new and improved equipment, weapons, methods and techniques;

(b) to act as the Board's representative and liaison officer for any particular project of research and development undertaken;

(c) to direct operational research required by the Board;

(d) to keep in close contact with corresponding organisations and with appropriate academic and industrial establishments, so as to keep abreast of current developments and to advise on the application of new methods and techniques to Naval problems.

Mr R.J. Gossage, Senior Principal Scientific Officer, RNSS, was nominated and he took up duty on 1st February, 1955. His original three year tenure was later extended and Mr Gossage was succeeded by Mr Peter Ward from the UK in 1959. Mr Ward was relieved by Mr Phil Horton, also from the UK, who died after a boating accident in Queensland late in 1964. The title of the position was changed to Director of Scientific Services (DSS) and Mr J.P. Lonergan succeeded Mr Horton. Jack Lonergan had a distinguished career in the public service, retiring in 1981 as Deputy Secretary of the Department of Science.

Mr J.P. Lonergan, later to be the Deputy Secretary of the Department of Science.

Mr M.W. Buckham succeeded Mr Lonergan as DSS in 1969. The title of the position was again changed, this time to Superintendent Naval Scientific Services (SNSS). Mr Buckham remained in the position until functional separation took place as a result of the reorganisation of the Defence Department on 28th January, 1975.

PREPARATIONS FOR A LABORATORY

During his visit to Melbourne in March 1954, Dr Cook had offered to make available to the RAN information on a new method for long range passive acoustic detection of submarines using interferometry. Sharing of this information and technology was contingent on the RAN acquiring scientific staff to do the necessary environmental research and development. In August 1954 an Australian team visited the UK to find out what was involved - the team was Cmdr. Frank Lord, RAN, John McNeill from MSL (scientific team leader), Gus Schaeffer from ARL (operations research) and Ron Wright from the ordnance Factory (engineering). In London, they were joined by Stan Lott from DSL (electronics). The team returned to Australia in March/April 1955 and reported their findings.

On 14th February, 1955, the first meeting of a newly formed Underwater Acoustics Committee took place. Members from the Australian Departments of Defence, Navy and Supply attended. It was agreed that the Australian Defence Scientific Service (ADSS) of the Department of Supply would assist the Navy in initiating a project to undertake oceanographic measurements with a view to ascertaining the probable effectiveness of the UK submarine detection system in Australian waters. Furthermore, the ADSS would withdraw from the project at an appropriate time, as it was agreed that further work would be more suitable for an organisation under Mr Ray Gossage, the Scientific Adviser to the Naval Board.

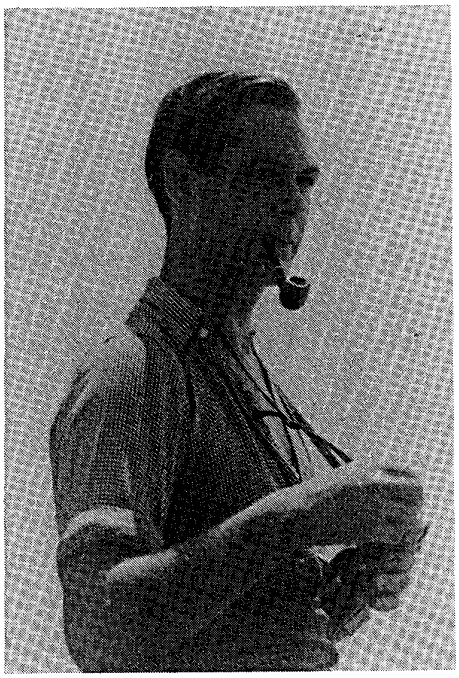
In September and October, 1955, the Navy formally recommended to the Departments of Supply and Defence that the joint project be terminated and that the Navy continue with the oceanographic and acoustic propagation studies currently in hand.

By the end of 1955, the Naval Board had approved the formation of a civil establishment with six Scientific Officer/Experimental Officer staff, four technicians and eleven supporting staff to be employed under the Naval Defence Act. In addition, four Scientific Officers (SO) were to be recruited for training in the UK for two year periods. This approach had been used in 1948 by the Department of Munitions to provide research staff for the Woomera Rocket Range. (Morton, 1989)

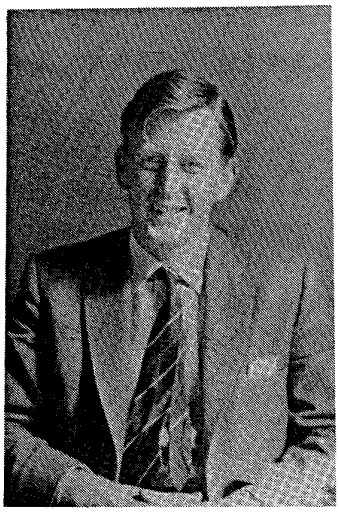
RAN EXPERIMENTAL LABORATORY (RANEL)

The laboratory officially commenced work on 16 April 1956 under the first Superintendent, Cmdr. F.F. Lord, RAN with a staff of four - Dr Arthur Pryor, Dr Doug Campbell, Mr Stan Lott, and Mr Danny Collins (clerk). During 1956, Frank Charnock (driver), John Carnell (labourer), Joe Abrahams (storeman), Claire Elliot (typist), Peg Worrall (library assistant), Eric Kaye and John Jackson (experimental officers), and Alan Thompson and Frank Harper (technicians) joined the laboratory. Doug Campbell left in the spring of 1956. In November 1956, Mr Ian Gatenby (SSO) and Mr Peter Clynick (SSO) from HMUDE, Portland, UK, joined on a three year loan from the RNSS. In December 1956, Stan Lott left to return to DSL. In January 1957, Bill Hunter, the first of the four scientific officers to be trained in the UK joined and Arthur Pryor left to join the Australian Atomic Energy Commission at Lucas Heights south of Sydney. Of

that initial group, Abrahams, Kaye, Harper and Hunter all stayed at RANRL until they retired. Those scientists who left early in the laboratory history were uncomfortable working under a naval superintendent.



Mr Peter Clynick



Mr Ian Gatenby

RANEL was originally located in two classrooms and an office in the northern building of HMAS Rushcutter at Rushcutters Bay in the Sydney suburb of Edgecliff on the shores of Port Jackson as shown in the chart on page 2. In 1957, RANEL moved into the Sayonara building at the south end of the site.

Over the next two years, the staffing decisions previously discussed were implemented and no significant change in the organisation occurred. However, in a report dated 13th March, 1958, a working party set up by the RAN Scientific Policy Committee recommended that:

> 'The scope of RANEL should be enlarged from its present status of a purely experimental laboratory, to allow it to become a flexible organisation capable of conducting a variety of work for technical directorates. RANEL should undertake all RAN scientific work and assist technical directorates in this field, and should generally undertake such work of a scientific nature which falls outside the normal duties of naval officers and ratings.'

Subsequently the laboratory's role was expanded and its staff increased to cater for Service requirements of a scientific nature. The Superintendent's appointment remained a naval officer until 1968, when the position was changed to the senior civilian scientist.

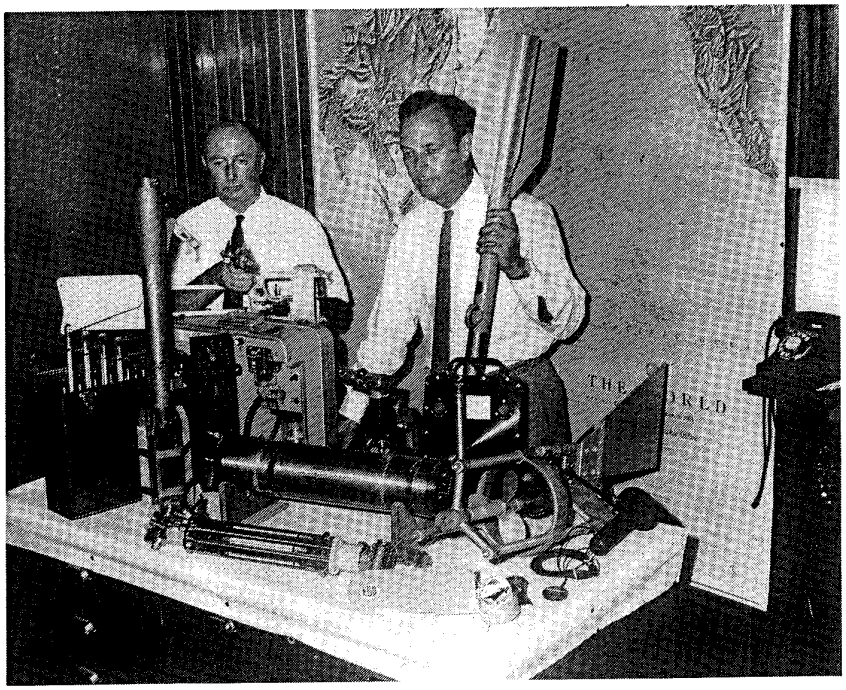
During the period 1956 to 1968, the following Naval officers filled the Superintendent's appointment:

CMDR F.F. Lord	13/02/56 - 14/08/57
CMDR H.G. Baker	15/08/57 - 14/12/59
CMDR E.P. Keatinge	15/12/59 - 30/11/61
CMDR N.A. Boase	01/12/61 - 26/09/62
CMDR R.J. Scrivenor	07/01/63 - 30/04/63
CMDR J.L.W. Merson	01/05/63 - 19/04/64
LCDR G.B. Thrum	20/04/64 - 16/05/65
CMDR J. Lancaster	17/05/65 - 04/02/66
CMDR R.E. Lesh	05/02/66 - 28/11/67
CMDR B.L. Cleary	29/11/67 - 31/07/68

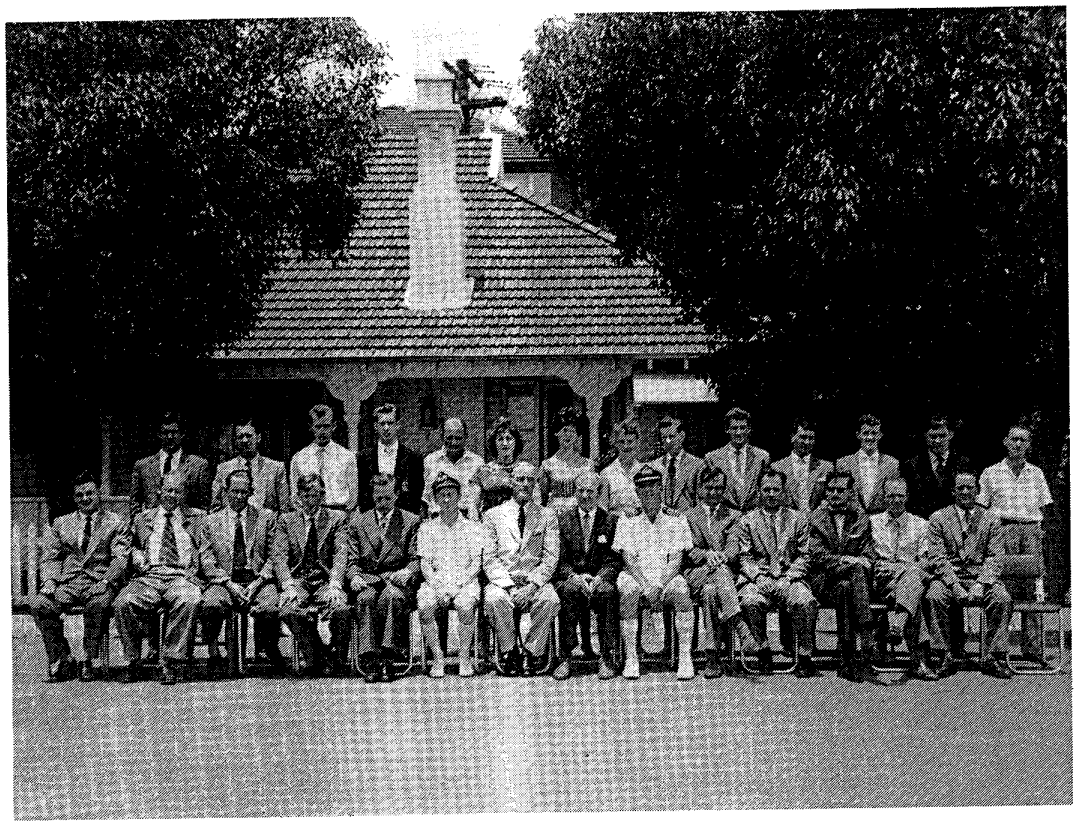
The Principal Scientists of the RAN Experimental Laboratory during this period were:

Mr I. Gatenby (seconded from the RNSS)	1956 - 1958 (acting)
Mr J.P. Lonergan	1958 - 1964
Mr R. Wyber	1964 - 1968

In late 1968, Mr Wyber became the Superintendent and held the position until his sudden death on 21 May 1970.



Bob Wyber (on the right) and Oscar Cook in 1968 with a selection of oceanographic equipment of the day.



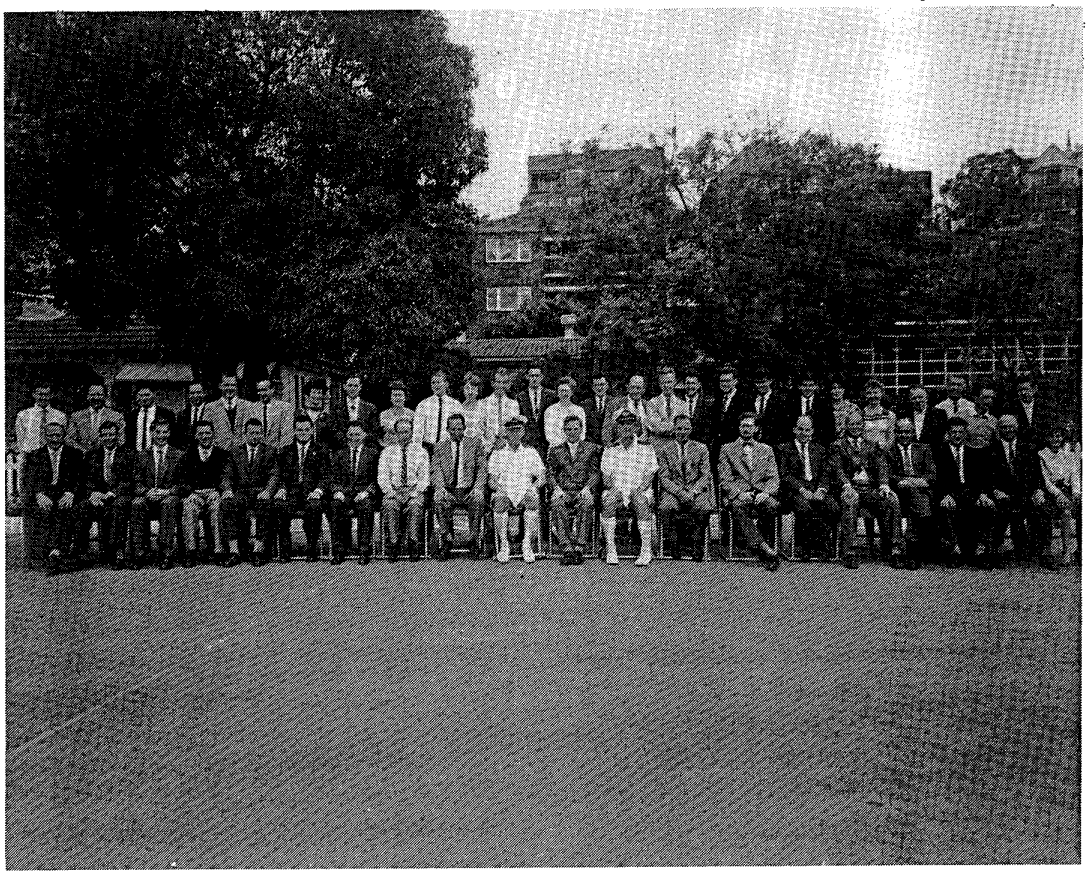
RANEL GROUP PHOTO 1959

BACK ROW (l. to r.) : A. Thompson, F. Harper, A. Phillips, R. Garrett, R. Gibson, G. Goldsmith, C. Chittock, J. Mäthenius, G. Kimpton, B. Bevan, D. Myers, B. Dwyer, J. McQuade, J. Abrahams

FRONT ROW (l. to r.) : D. Stewart, W. Hunter, E. Kaye, I. Gatenby, J. Lonergan, CMDR H. Baker, RADM K. Urquhart, P. Ward (DSS), CMDR E. Keatinge, P. Clynick, R. Wyber, J. Jackson, G. Grenfell, N. Cassidy.

(Absent : L. Rippon, G. Ellis, M. Westwood, W. Turner, L. Woelms, J. Winter)
Photography by George Young

(Note the Captain's Cottage in the background.)



RANEL Group Photo 1961

BACK ROW (l. to r.) : B. Dwyer, G. Gardiner, H. Jackson, R.. Jones, N. Anderson, N. Powell, C. Chittock, R. Balfour, G. Goldsmith, J. Kick, M. Swords, E. Tonurist, D. Cato, P. Savage, R. Caldwell, R. Long, R. Richmond, B. Sheppard, T. Kings, J. Fazio, D. McLucas, S. McNamara, J. Mäthenius, L. Rippon, F. Dawkins, J. Abrahams, G. Kimpton.

FRONT ROW (l. to r.) : A. Adams, J. Winter, R. Garrett, F. Harper, L. Rasmussen, D. Stewart, J. Johnson, G. Grenfell, E. Kaye, CMDR N. Boase, J. Lonergan, CMDR E. Keatinge, R. Wyber, J. Jackson, W.J. Turner, W.F. Hunter, G. Ellis, B. Bevan, O. Cook, J. Lopez.

Photography by Jim Myers (RANEL)

The laboratory's initial project focussed on the detection of submarines by underwater hydrophone arrays in a project named EDMONDS. The first field experiment was in Sydney Harbour. Two hydrophones were deployed from the bow and the stern of HMAS Kookaburra, and with the Admiral in attendance, laboratory staff listened for passing vessels. One cable parted and half the laboratory's hydrophone stock was lost before the Admiral's eyes without hearing any vessels. Such is the nature of field experiments.

In 1958, Jack Lonergan joined the laboratory from the Department of Supply as Principal Scientist (PSO). Whereas the original senior scientific staff had been uncomfortable working under a naval superintendent, Jack Lonergan made the laboratory work within the naval framework. Because the experiments at sea were quite demanding, he recruited staff (particularly technicians) with a naval background and this made cooperation between the laboratory and ships much smoother. A dynamic and dedicated organisation developed.

It was the view at the time that the identification of naval problems which might be amenable to scientific involvement could best be achieved when scientists went to sea to observe the various equipments in operation. A practice of close contact between the laboratory staff and the Navy developed early in the history of RANEL and provided the basis of much of its early success. New staff joining the laboratory were usually sent to sea and on naval training courses as soon as possible to expose them to their customers and to instil a spirit of cooperation. Naval officers were seconded to the laboratory at various times. Mutual confidence increased and the Naval Staff asked the laboratory to undertake a number of Operations Research tasks.

Jack Lonergan recruited Morry Frost from the University of Sydney where he was studying with Professor Tom Fink who was later to become Chief Defence Scientist. Mal Buckham, the third scientific officer to return from initial training in the UK, and Morry Frost provided an effective program of advice to the Naval Staff and their early successes led Jack Lonergan to agree to a series of exercise analyses. This program was highly successful and led to the laboratory being invited to do some analysis of SEATO exercises.

Towards the end of Jack Lonergan's period of leadership, he went to the US with Bill Hunter to present the results of EDMONDS at the USN Underwater Acoustics Symposium. There was an increase in the importance of the laboratory's links with the US. When Jack Lonergan accepted the position of DSS in Canberra, Bob Wyber, who became the Principal Scientist, expanded the contacts with the USN, arranging exchanges with US oceanographers Bob Lockerman, Laurie Jarvela and J.C. France. One of the Australians to go on exchange was Paul Scully-Power who later resigned from RANRL to work in the USA. Bob Wyber also put in place an agreement with the University of NSW that allowed laboratory staff to complete PhD degrees based on their laboratory work.

In October 1965, the Naval Board approved an increase of staff to meet burgeoning commitments:

Type of Staff	Previously Approved Positions	Positions Approved October 65	Positions Occupied October 65
Professional	17	28	12
Technical	26	30	19
TOTAL	43	58	31

The organisation consisted of three scientific groups:

(a) Underwater Physics (Group Leader W.F. Hunter)
(b) Operations Research (Group Leader M.W. Buckham)
(c) Fluid Mechanics & Underwater Weapons (Group Leader W.J. Turner)

These scientific groups were supported by an Engineering & Trials Group with E. Kaye as Group Leader. A naval officer LCDR (GLEX) was seconded to the Operations Research Group. Administrative support included clerical, transport and library staff.

The laboratory provided a supportive environment for people to obtain further qualifications. Several technical staff obtained University degrees part-time. J. Tonurist (nee Mäthenius) for example, who started as computing assistant, obtained a BSc by 1967, an MSc by 1971, became a research scientist in 1971 and was promoted to senior research scientist in 1973.

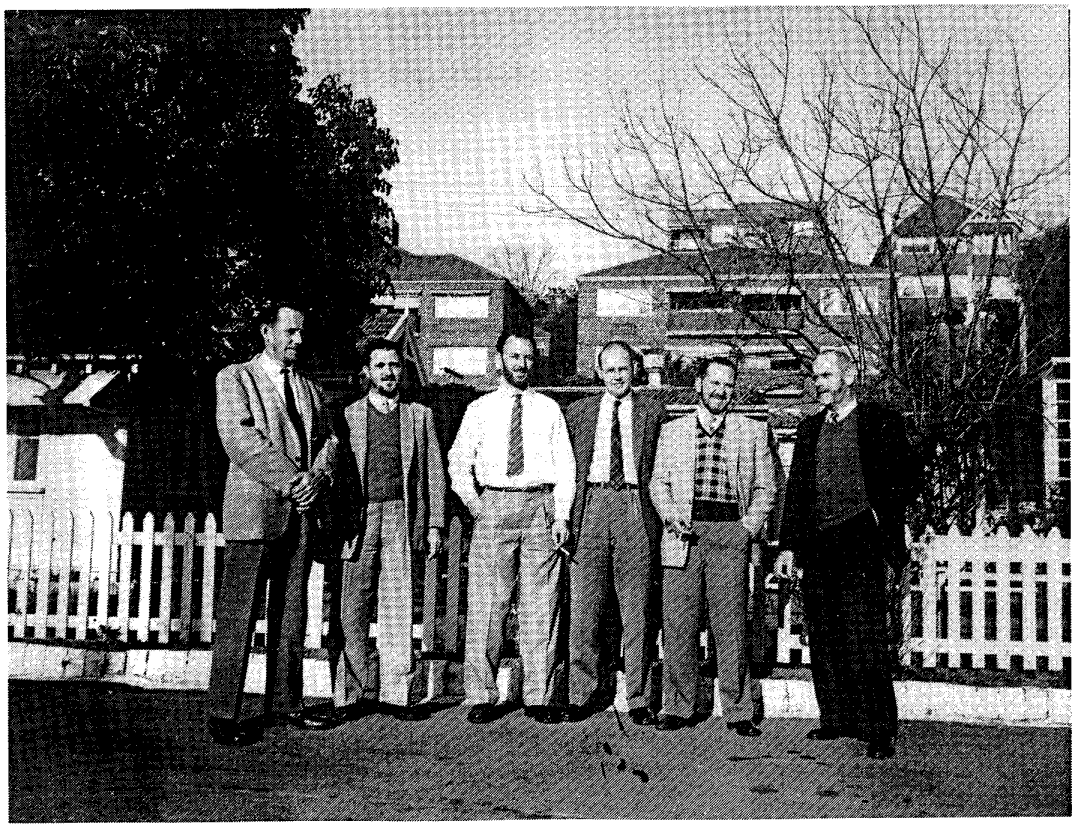
Bob Wyber served as a sonar operator on a corvette during World War II and he continued to foster the close co-operation between the laboratory and the RAN. There was, however, less exposure outside the Defence Group due in part to the classified nature of much of the research. One public window was the court martial of the commanding officer of HMAS Melbourne following her collision with USS Evans in 1969. Bill Hunter was called by the president of the court as an expert witness. HMAS Melbourne had collided with HMAS Voyager in 1964, an event recounted by Frame (1992), and it was dramatic public news when a second collision occurred five years later. After Bill Hunter presented his analysis of the ship's manoeuvres, the court ruled that the commanding officer had "no case to answer".

The laboratory was off on a firm footing, occupying an historic Naval site and with an expanding range of activities that justified the name change in 1969.

EARLY SEA TRIALS

The Laboratory started its life carrying out field experiments and these activities set much of the early culture. The RAN provided the vessels that were needed to make oceanographic measurements and deploy hydrophones for the early underwater acoustic measurements that were made around the Australian coastline. The first RAN ship to be used by RANEL for oceanographic survey work was HMAS Kookaburra, a converted Boom Defence Vessel similar to HMAS Kimbla which replaced her.

In the earliest experiments a hydrophone was suspended from the trials vessel and recordings were made on board. The hydrophone was very heavy, the available cable not very robust and the ship's winch not very suitable, so listening depths were limited to the edge of the continental shelf at about 100 fathoms and to relatively calm weather. Equipment failures were common. RANEL engineers set about improving these deficiencies. Eric Kaye designed a special winch, lighter hydrophones were purchased from the US, and a strong four cored electrical cable was developed in cooperation with Australian industry (Cable Makers Australia). Buoys were developed which could support this cable and a VHF antenna, so the acoustic signals from an array of two hydrophones could be telemetered to the ship or to a shore station. This enabled recordings to be made in weather up to sea state 4. A Mobile Shore Station (MSS) was established in a caravan which could be towed to a suitable hill to record the signals from the array and an Analysis Section was established to process the acoustic data.



July 1961 RANEL Trials Team

(l. to r.) E. Kaye (engineer), F. Harper (technician), R. Wyber (scientist), W. Hunter (scientist), G. Gardiner (technician) G. Ellis (technician)

"SUBJECT: - HMAS Kookaburra" - Programme for the period Monday, 10th September, to Friday, 14th September, 1956.

***REFERENCE:** F.O.I.C.E.A. Signal 030020Z/May, Item U.*

Survey - Port Hacking Area

Serial 1
A detailed survey is to be made of the bank centred on position 34° 05.6' S : 151° 16.8' E. In particular, soundings are to be made on a suitable grid of intervals not exceeding half a mile. Bottom samples are to be taken along the centre at intervals of half a mile using dredge and, if possible, corer. A large scale plotting sheet is to be prepared so that any irregularities not fully covered by the grid may be further examined before the area is left. Sufficient information is to be recorded on the plotting sheet and E/S rolls to enable soundings to be reduced to chart datum.

Serial 2
An echo-sounding profile is to be run from position S30 along a line bearing 120° for a distance of 30 miles or until a depth of 1,000 fathoms is recorded, whichever is reached first. Bottom samples are to be taken at intervals of 1 mile for five miles and thereafter at five mile intervals out to 500 fathoms. Dredge or scoopfish should be used. Salinity samples are to be taken using Nansen bottle, at intervals of 10 fathoms to 40 fathoms, thereafter at 20 fathom intervals to 100 fathoms and, where depths permit, one sample from 200 fathoms. Samples are not to be taken within 10 fathoms of the bottom. A bathythermograph dip is to be made at each station.

Serial 3
From position S30, an echo-sounding profile is to be run on a bearing of 272° as far as safe navigation permits. Bottom samples are to be taken using the dredge or scoopfish at intervals of 1 mile. Salinity samples and bathythermograph slides are to be taken at each station. Salinity samples are to be taken at 10 fathoms intervals, the deepest being not less then 10 fathoms from the bottom.

Serial 4
An echo-sounding profile is to be run on a bearing of 109° from a point as far inshore as safe navigation permits, through position S20 (at 100 fathoms) to a point 20 miles beyond or to a depth of 1,000 fathoms, whichever is reached first. Bottom samples are to be taken at intervals of two miles from inshore to the forty fathom line, and at intervals of five miles beyond this point. Dredge or scoopfish should be used. Salinity samples and bathythermograph dips are to be taken at each station. Intervals for salinity samples should be as for Serial 2.

Identification of Samples
It is sufficient to serially number all samples providing these numbers are carefully recorded in the appropriate column of each data sheet.

Use of Forms
The forms included are prepared for convenience and are not intended to be mandatory in any particular.

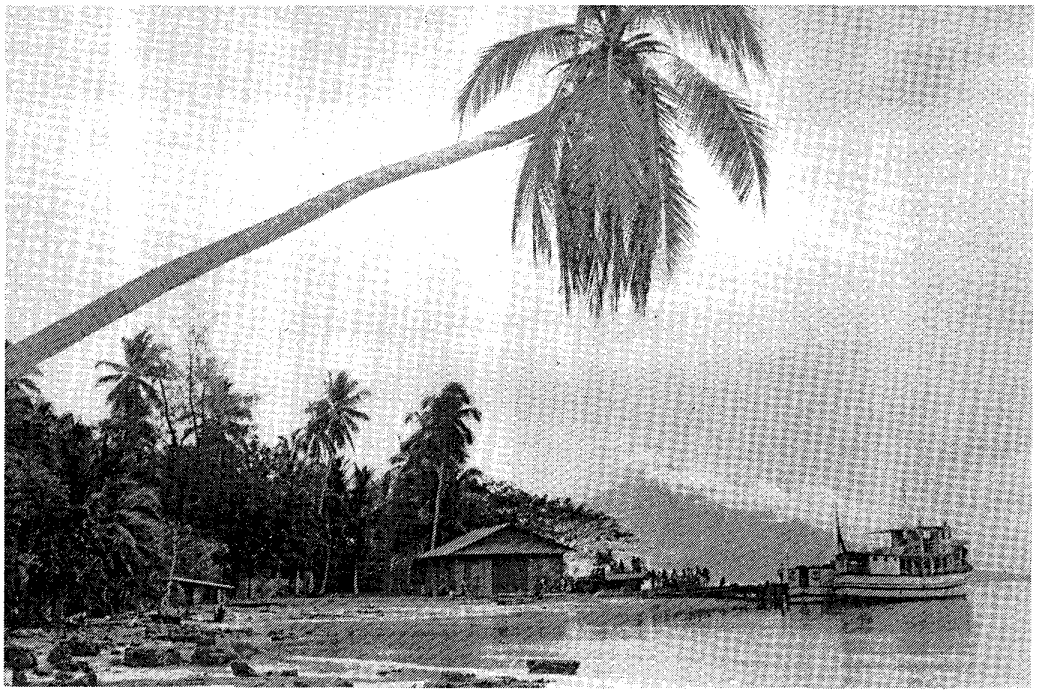
A typical Trials Proposal from RANEL's early years.

As technology improved, arrays of four hydrophones could be deployed on the four cored cable to depths greater than 400 fathoms. Instead of developing larger buoys to support the considerably greater weight of cable, RANEL sought sites where the seabed sloped steeply enabling the cable to be brought ashore. A permanent shore station was built at Montague Island off the south coast of NSW which, in addition to acoustic detection trials, enabled submarines to be sound ranged for their self protection.

Later, in the RANRL era, even more capable arrays were laid off Christmas Island and monitored from a station on the island.

Little equipment was available for analysis of the data, so Jack Lonergan introduced 24 hours a day shift work for about a year in order to produce a timely status report to Navy Office in 1964.

Another interesting feature was the "37½ % sea trials allowance". Most experiments at sea ran 24 hours a day so staff worked in watches, but specialists often had to turn out when off watch to assist with repairs. Normal overtime rules were very difficult to administer and control so staff were paid a "trials allowance" amounting to being paid a flat 137 ½ % of normal pay while at sea provided they worked enough extra hours each week to be equivalent to the 37 ½ % extra pay. In other words, the pay was capped but the work hours were not. Nevertheless, there was never any trouble getting volunteers to go on these sea trials - particularly when visits were made to exotic locations which many saw as an adventure. Scientists, engineers and technical staff lived and worked well together in teams (as seen in the photograph of the 1961 trials team on page 13). Many sites in the Tasman Sea were investigated - off the Solitary Islands, Smoky Cape, Gabo Island, Montague Island, Port Jackson and others, and a few sites further away - Lord Howe Island, Bathurst Island and Manus Island, north of New Guinea.



Late 1960's trial - New Guinea on the way to Manus Island. (photo : Eric Kaye)

The equipment store, which had a staff of two, was an integral part of each trials preparation team. Friendly reminders from Joe Abrahams often saved a Trials Officer from the embarrassment of omitting a piece of equipment needed for an experiment at a remote location.

This was both an exciting and a difficult time. The Laboratory was trying to develop innovative technical solutions within a Navy steeped in British tradition and operating in a country with a small technical base. Many hurdles, both technical and bureaucratic, had to be overcome to actually perform field experiments. The early field teams of the RAN Experimental Laboratory showed the determination needed to succeed.

RUSHCUTTER SITE HISTORY

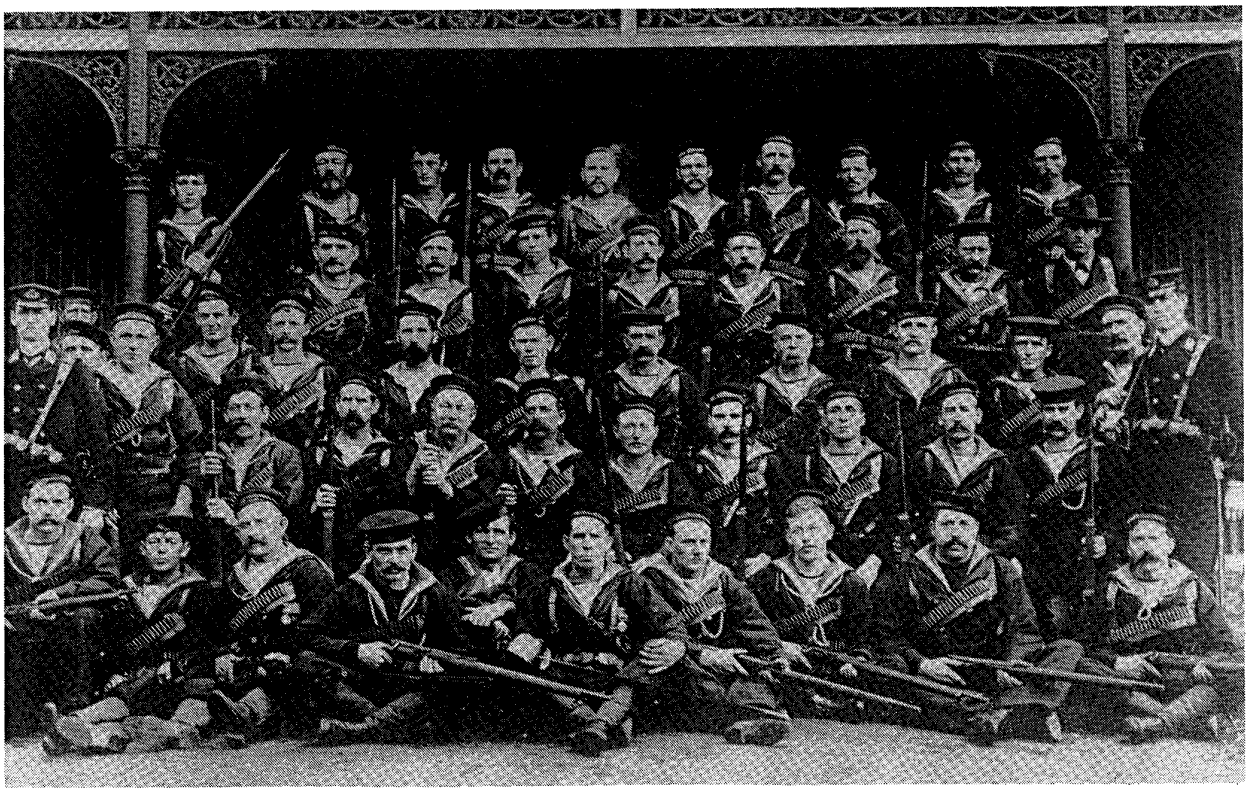
The site of the RAN Experimental Laboratory has played an interesting role in the history of Australian Naval activity. The Royal Navy maintained an Australian station from 1859 with a Commodore commanding Naval assets. Their activities were concentrated around Garden Island and Circular Quay.

By the mid 1850's, New South Wales had been granted responsible government and after the Colonial Naval Defence Act (1865) granted colonies the right to form their own navies, the Naval Brigade, modelled on the Imperial Naval Reserve, was formed under the Volunteer Force Regulation Act of 1867. The Brigade comprised ex Royal Navy petty officers and sailors under the command of Captain Francis Hixson, RN.

Pre-Federation to 1940

A site on Rushcutters Bay was chosen for the Brigade's parade ground and drill hall. The galvanised iron buildings at Rushcutters Bay probably date from the early years of the 1890's. The earliest map showing a maritime structure at Rushcutter dates from 1894. It shows a short jetty with an integrated shed and some adjoining structures. The existing 'Captain's Cottage' (married quarters) was built about 1900 and used as the residence of the Commander of the Naval Brigade. The cottage was listed by the National Trust in November, 1979.

Both New South Wales and Victoria sent Naval Brigade contingents to fight in the Boxer Rebellion in China in 1900. The New South Wales volunteer contingent was commanded by Captain Hixson. The men were kitted out at Victoria Barracks and then marched to Rushcutters Bay for training before embarking from Circular Quay for China on the SS Salamis and HMCS Protector.



'A' Company of the New South Wales Naval Brigade Contingent at Rushcutters Bay before embarking for China, 1900.

Boxer Rebellion Contingent of the NSW Naval Brigade. For more information see Nicholls (1986).

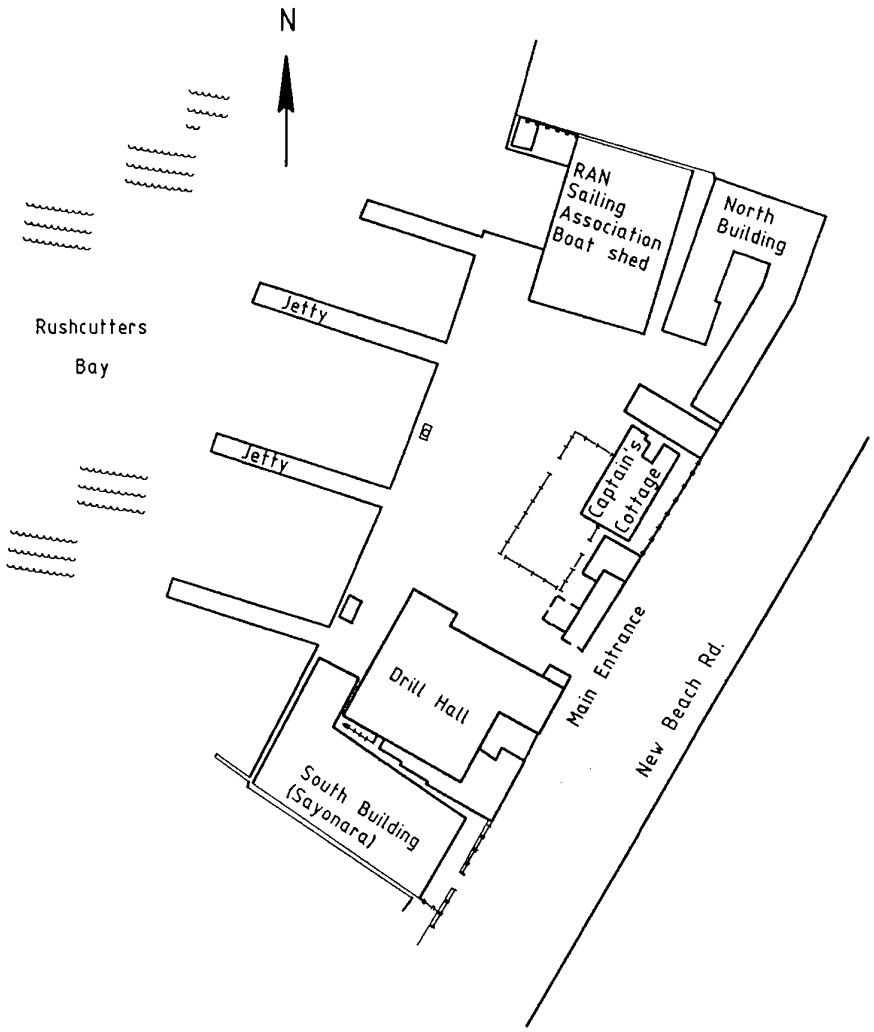
Following Federation, the ships and personnel of the States' Navies, including the Naval Depot of about 5000 square metres at Rushcutter, were transferred to Commonwealth control on 1st March 1901. A further 986 square metres was acquired in 1948 from the state government.

On 1st July, 1902, the amalgamation of the Naval Brigade and Naval Artillery Volunteers took place and the new organisation became known as the New South Wales Naval Brigade. For many years the Brigade continued to function as a training establishment and was known as the RAN Reserve Depot, Beach Road, Sydney. The Rushcutter Depot was used for training the State Naval Brigades until they disbanded in 1907. The Naval Militia was formed from volunteers from the defunct State Brigades and operated until 1911.

The formation of the RAN, on 10th July 1911, is described by Hyslop (1973). Australia was divided into Naval Districts for the training of the Citizen Naval Forces. The District Naval Officer, Sydney, was located at Rushcutter, under Commander F.H.C. Brownlow, RN, who had joined the Naval Artillery Volunteers, New South Wales Defence Force as a Sub-Lieutenant in 1889. In October 1911, the Citizen Naval Forces were renamed as the Royal Australian Naval Reserve.

From the early 1900's, the Rushcutter Depot was called HMAS Penguin and on the outbreak of World War II, the Rushcutter Depot commissioned as HMAS Penguin II. On 23rd April 1940, all establishments in the Sydney area were combined for administrative purposes as HMAS Penguin and the name Penguin II lapsed. HMAS

Penguin remained the name of the Rushcutter site until the title HMAS Rushcutter was adopted by Naval Order No. 151 on the 1st August, 1940.



The Rushcutter site

In 1940, consideration was given to building a new depot at 'Rushcutters Bay' on five acres of land north of the original Rushcutter site or alternatively on three-and-a-half acres adjacent to the then existing tram sheds. However, a site at Hunter's Bay in Balmoral was preferred for the new depot and that site is now known as HMAS Penguin.

The War Years (1939 - 1945)

During the second world war, the Rushcutter site was used for technical activities that predated the establishment of a "scientific" organisation under the control of the Naval Board. This board, which had the minister as president, four admirals as members, together with the Secretary of the Navy, ran the Navy in a very similar manner to the way the Royal Navy was managed.

In 1938, the establishment of an Australian Anti-Submarine School on the Rushcutter

site was announced. The training staff - one Commander and six Petty Officers S/D (Special Duties) instructors, were loaned from the RN. Commander H.M. Newcomb, RN, was appointed acting Commander of HMAS Penguin and, in addition, OIC Anti-submarine School, Sydney, by the Australian Commonwealth Naval Board on 22nd November 1938.

The first group of 66 officers completed their courses before the outbreak of the second world war and formed the backbone of anti-submarine personnel afloat at that time. Once the war began, a considerable increase in training facilities was urgently needed and Rushcutter facilities were expanded to add more instructional staff, classroom space and mechanical gear.

On the cessation of hostilities in the East in 1945, training gradually lessened. At this time work was suspended on various projects in order to commit space to house the Demobilisation Staff, and it appeared probable that the site would eventually be transferred to the Woollahra Council. The School was eventually transferred to HMAS Watson.

During the war years HMAS Rushcutter was also responsible for the seaward defence of Australian ports. The responsibility entailed such duties as cable laying and repair, deployment of vessels, electrical fitting, shore maintenance, manufacture and repair of anti-submarine equipment, training of personnel and the drafting of officers and ratings to various stations.

In May, 1939, the laying of a system of Indication Loops in Port Jackson and its approaches was undertaken by HMAS Kookaburra and SS Mernoo under the supervision of Commander H.M. Newcomb, RN This defence system, designed to detect the magnetic signature of submarines, consisted of five loops forming an outer system, and a loop between South and North Heads which formed the inner guard loop. During the course of the war, loops were raised and lowered to allow for repairs and dredging. Magnetic Indicator Loops were also laid in other major New South Wales ports, interstate ports and in New Guinea waters.

Harbour Defence Motor Launches (HDMLs) and 'B' Class Fairmiles were used for harbour defence. A Fairmile training school was established at Rushcutter under the command of Lieutenant Commander Plunket-Cole, RAN. Training commenced on 1st June 1942 and the last class concluded on 31st August 1945. After November 1944, the organisation was modified to assume the functions of a Coastal Craft Base, concerned mostly with maintenance and refitting vessels. After peace was declared, the Rushcutter motor launches were paid off and staff numbers began to fall.

The Radar Branch, or R.D.F. Branch as it was called, was established in August 1941. In December 1941, the Radar Branch was transferred to the staff of the Engineer Manager, Garden Island as a temporary expedient until the arrival of an active Service Officer who was to take over complete control under the Commanding Officer, HMAS Rushcutter.

At the end of December, 1943, the Officer in Charge and the Administrative Section moved to the Radio School, South Head, leaving the technical staff at Rushcutter. This move was followed almost immediately by that of the Test and Survey Section which moved to Leichhardt Naval Stores. The only departments then left at HMAS

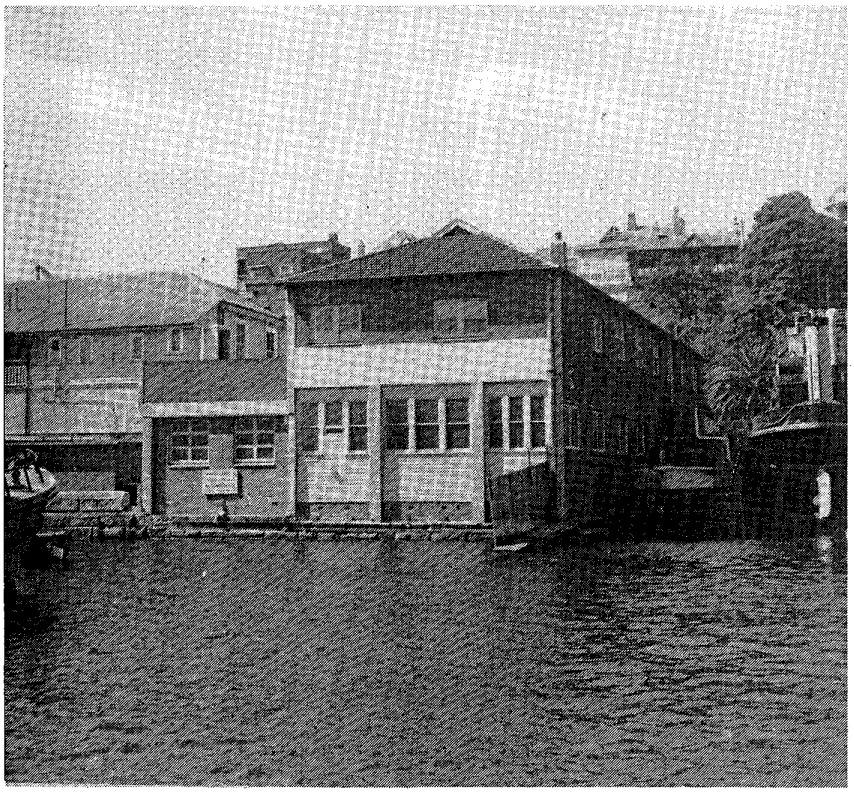
Rushcutter were the Radar Laboratory and the Local Production Office. These departments occupied the Sayonara building pictured below. Although completely dispersed, the Radar Branch still remained a Rushcutter commitment until the commissioning of the Radar School as HMA Radar Training Establishment (at HMAS Watson) on 14th March, 1945.

The role of women in society was changing during the war and, on the 18th November 1942, training for WRANS commenced at HMAS Rushcutter. Instruction included lectures in the Drill Hall and drill and sailing in the depot's whaler. Included in the first course were Drivers, Messengers and Writers. It was also an important day for the WRANS when the Governor-General, The Duke of Gloucester, took the salute in Rushcutter during a march past.

Post War Years (1945 - 1984)

After the war the WRANS Training School was closed down and the Torpedo and Anti-Submarine Training School was transferred to HMAS Watson in 1955. Rushcutter assumed duties such as Diving Training and Operations, Underwater Medicine and Bomb, Mine and Missile Disposal.

In 1948, the RAN Diving School was relocated from HMAS Penguin to HMAS Rushcutter. The training included salvage operations, mine-clearance and underwater combat operations. The Diving School was transferred back to its present site at HMAS Penguin in 1968.



Rear view of RANRL - South (Sayonara) Building

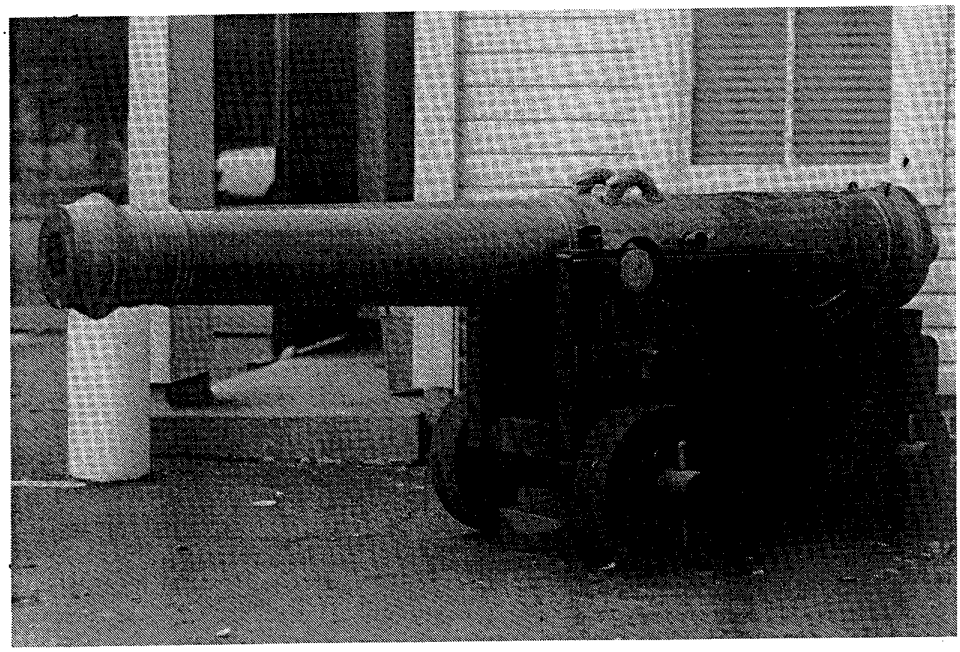
On the introduction of the guided missile destroyers (DDGs) into the RAN in the mid sixties, together with their modern Fire Control and Weapons Systems, it became

apparent that a need existed for a combined Test and Evaluation Team. The TARTAR and IKARA Weapon Systems are now regarded as the catalysts in the eventual formation of that team. The team was created on the 6th November, 1966, and was given the name RAN Trials and Assessing Unit (RANTAU).

RANTAU was initially located at the Gunnery Instruction Centre, Woolloomooloo and brought together a small Fleet Support Group from RANEL and other specialist groups from existing establishments. After a short period in York Street, Sydney, RANTAU moved into space vacated by the RAN Diving School in Rushcutter in 1968. RANTAU moved into the Edgecliff Centre in 1972, and then to North Sydney in 1975.

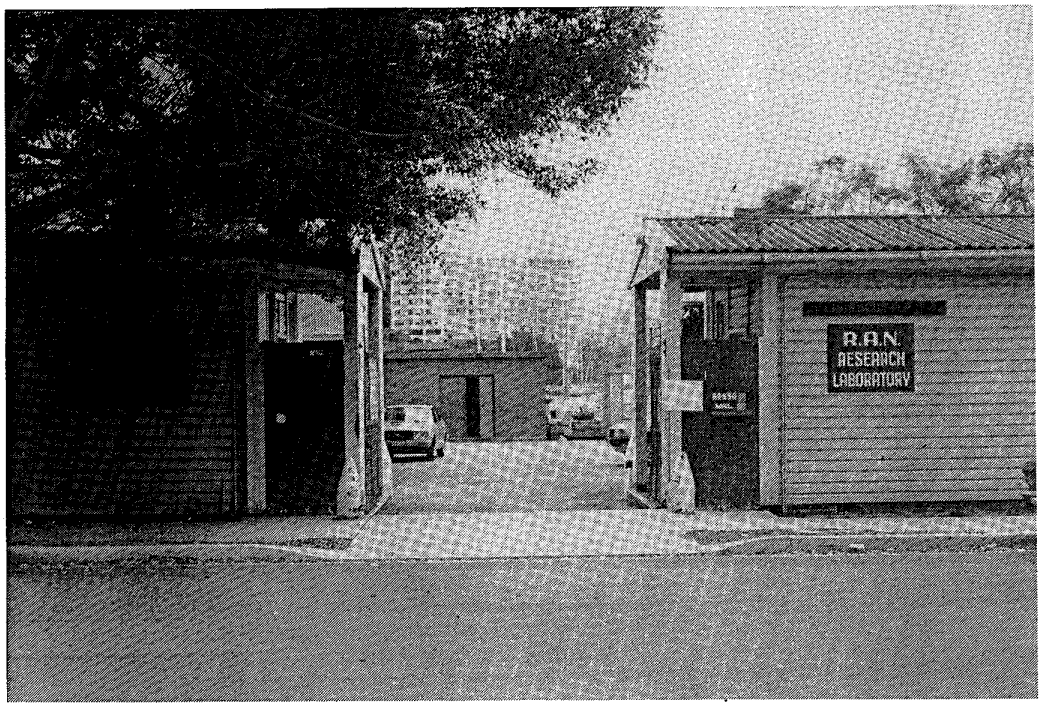
The RAN Reserves were officially transferred from Rushcutter to HMAS Waterhen on the 20th August, 1966 and HMAS Rushcutter was officially decommissioned on the 26th July, 1968.

RANEL commenced in two classrooms and an office in the north building of the Rushcutter site in 1956. In 1957, RANEL moved to the Sayonara building at the south end of the site and in 1962, this building was extended to cater for increasing staff levels and to provide more workshop and library space. When the Diving School left Rushcutter in 1968, RANEL expanded into the space they vacated in the Drill Hall area, then when RANTAU left in 1972, RANRL took over the whole of the Rushcutter site with the exception of the RAN Sailing Association boat shed.



The Rushcutter Culverin
The entrance of the Rushcutter site was guarded for many years by this ancient gun. Cast in 1595 by Juan Vasquez of Acuna, the Captain General of the Artillery of the Kingdom of Naples, for King Phillip II of Spain, it weighed some 4,431 lb., fired a 12½ lb. shot and incorporated lessons learnt from the Spanish Armada only seven years earlier. It was later owned by the Chinese and was presented by Lt. General Gaselee (who commanded the British Imperial Troops in China) in 1900 to the NSW Naval Brigade which accompanied the ships of the Australian Squadron in the Boxer War. The gun bears cannon ball scars and the Chinese characters for Sky 12 which probably designated the battery number in which it was used, possibly on the Great Wall. It was ceremonially fired by the Laboratory staff in 1968 to celebrate the fitting of a new carriage.

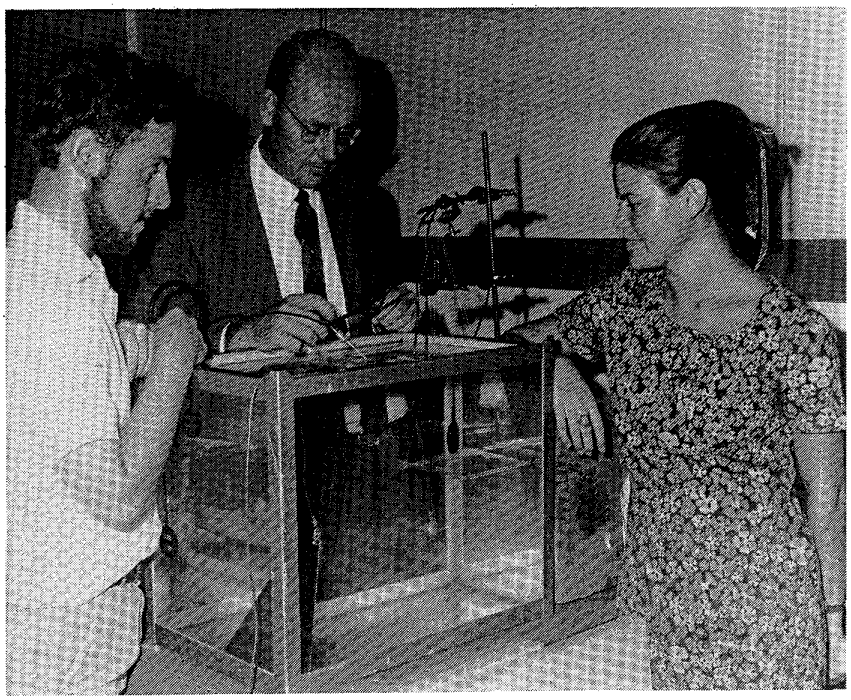
In May, 1977, the Government introduced new guidelines for the acquisition, management and disposal of Commonwealth properties. Under these new guidelines the site at Rushcutter was to be transferred to State control. Letters of Intent exchanged in late April, 1979, by the Prime Minister and the Premier confirmed that the Commonwealth would sell and immediately transfer the property (Rushcutter) to the State. The RAN Research Laboratory was to be relocated to the Royal Edward Victualling Yard at Pyrmont in 1984.



Entrance to Rushcutter site from New Beach Road (1972 - 1984). The RANRL sign and entrance were previously at the Sayonara building.

THE RAN RESEARCH LABORATORY 1969-1987

In early 1969, the name of the Laboratory was changed from the RAN Experimental Laboratory to the RAN Research Laboratory (RANRL). The laboratory reported to the Naval Board, making it the only research laboratory in Australia to be administered by one of the services. The total staff at that time was 64. There have only been two permanent occupants of the position of Head of the laboratory - Mr R. Wyber from 1968 to 1970, and Dr. W.F. Hunter for the remaining 17 years. During this time, M.D. Frost acted in the position for some three years while Bill Hunter was in Washington. John Waller, Ian Jones and Mike Turner also acted in the position for short periods on other occasions.



W.F. Hunter with two summer students, Anne Julienne and Bill Wilson, discussing an underwater acoustics experiment. Anne Julienne later became a RANRL research scientist.

The Research Laboratory continued to broaden its scope. It recruited staff with research degrees as well as encouraging a number of existing staff to obtain research degrees. Gerard Sutton studied at the Catholic University Washington on a Defence Scholarship and obtained a PhD in acoustics in 1971 while Marshall Hall, Attila Kamenyitzky and Doug Cato were awarded PhD degrees from Australian universities. New staff for research scientist positions increasingly came with research degrees.

RANRL Group Photo 1974

BACK ROW (l to r) : E. Hendricks, M. Williams, S. O'Brien, J. Huggett, P. Fitzgerald, M. Millington, R. Moore, J. Jacobs, J. Abrahams, A. Harper, A. Garner, P. McDonnell, J. McCredie, J. Manton, B. McMillan, J. Ranicar, F. Bruzzone, D. Cato, M. Hall, C. Nilsson, G. Cook, G. Lockey

3rd ROW (l to r) : P. von Sneidern, R. Willstead, M. Robinson, L. Criswick, J. Galloway, R. Ivory, K. Miller, P. Nysen, R. Smith, A. Fenwick, A. Latham, I. Bament, P. Thompson, R. Ming, G. Johnston, J. Charlier, P. Mayo, E. Vanderhoek

2nd ROW (l to r) : M. Bell, P. Kaye, B. Hindle, J. Watson, F.V. Harper, I. Coote, J. Thompson, B. Hanley, P. McBain, D. Briggs, M. Nadjek, H. Lawless, A. Julienne, D. Bisman, M. Barnes, I. Hagan, J. Andrews, S. Valentine-Flint, G. Saiva, J. Mahoney

FRONT ROW (l to r) : N. Anderson, B. Bevan, J. Tonurist, H. Pillow, G. Gardiner, J. Johnson, C. James, J. Waller, W. Turner, W.F. Hunter (Supt), I. Jones, A. Carter, Lt. R. Cameron, N. McKillop, P. O'Brien, G. Wurm, R.B. Jones, C. Lovegrove

(The masts of various yachts on Rushcutters Bay can be seen in the background)

On 28th January, 1975, a major reorganisation within the Department of Defence resulted in the formation of the Defence Science and Technology Organisation (DSTO). The RAN Research Laboratory was transferred from Naval administration to the Services Laboratories & Trials (SLT) Division of the Defence Science and Technology Organisation. The position of Superintendent RANRL was reclassified from Principal Research Scientist to Superintending Scientist. Legislation which came into effect on 9 February 1976 dissolved the Naval Board and on July 1, most staff were transferred from employment under the Naval Defence Act to the Public Service Act.

In February, 1982, as a result of a DSTO review, the Service Laboratories and Trials Division was disestablished. Control of RANRL was then transferred to the Deputy Chief Defence Scientist, in DSTO's central office. On 7 May 1982, the government split the Defence Department into two ministries by creating the Department of Defence Support. RANRL, together with other DSTO research and development laboratories, was transferred from the Department of Defence to the Department of Defence Support.

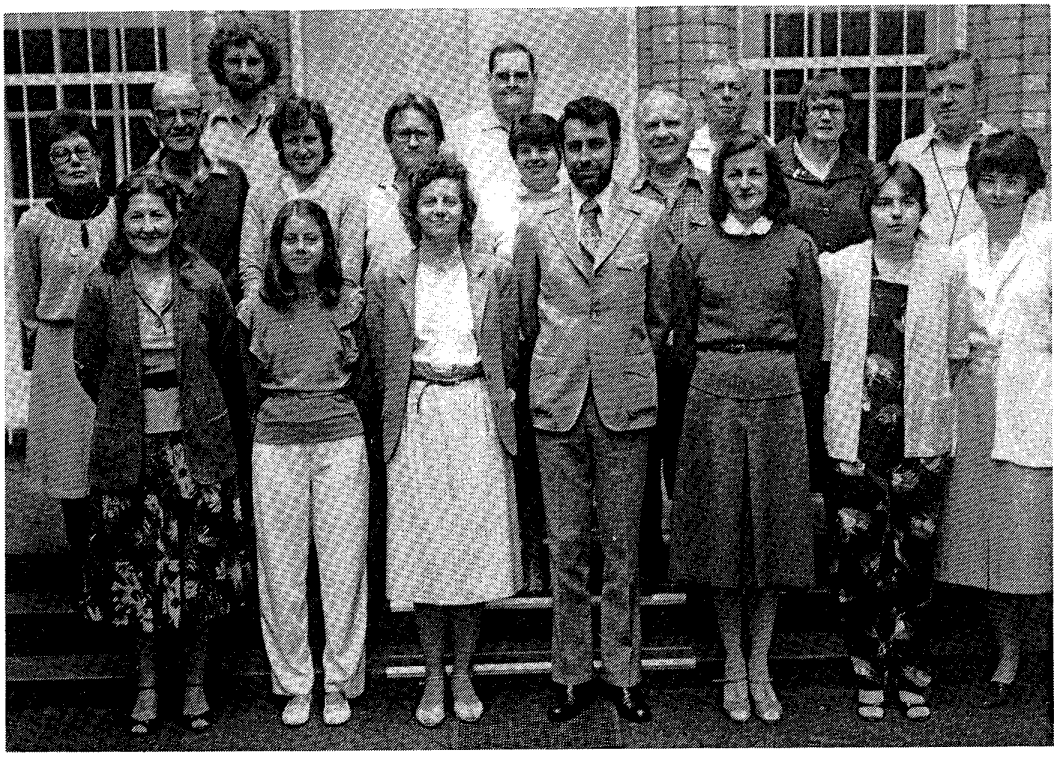
On the 27 August, 1982, the position of Superintendent RANRL was redesignated Director, RANRL. At this time, the establishment figure was 115, and the number of staff totalled 104, (These figures included all staff at RANRL including secondments, naval personnel, etc.). These figures remained reasonably static until 1 August, 1984.

At that time, RANRL consisted of four scientific groups practising a number of related disciplines, backed by an engineering group, specialising in Ocean Engineering. The groups were:

Group	Group Head
Operations Research	Mr M.D. Frost
Mine Warfare	Mr W.J. Turner
Ocean Sciences	Dr. I.S.F. Jones
Sonar & Surveillance	Mr J.C. Waller
Engineering	Mr C.A. James

This structure worked well with the operations research group providing input into the direction of the mine warfare, ocean sciences and sonar and surveillance groups. They in turn provided concepts and data for the operations research group in the studies of naval assets. The engineering group in turn developed the apparatus to allow data to be collected.

An administration group supported the above and provided library, store, purchasing and accounting functions. Administration had started as a clerical service run by a Public Service clerk and grew to number 22 people. The management of the Research Laboratory had evolved to include quarterly meetings of Group Heads which concentrated on different aspects of the operations at each meeting. The promotion and development of staff for example was the focus of the May meetings. Bill Hunter, as Head of the Laboratory for 17 years, had a major impact on its style. The early origins under the control of the Navy and the influence of the Public Service meant that it would always have a different culture from the other government science establishments, such as the CSIRO.



Administration Group 1982

BACK ROW (l to r) : R. Anderson, P. Voigt, L. Angel
CENTRE ROW (l to r) : M. Cairns, E. Hendricks, L. Smith, P. Clift, F. Burnsyde, V. Pilypaitis, F. Russell, A. Walker
FRONT ROW (l to r) : J. Leach, K. Butler, L. McMillan, C. Charnas, C. West, B. Staf, A. Russell

(Absent : E. Wonders, J. Loughry, S. Bisman, C. Schmidt)

In April 1983, the then Chief Defence Scientist, Professor P.T. Fink advised DSTO that all DSTO Laboratories had been transferred back from the Department of Defence Support to the Department of Defence. The effective date of this transfer was the 11 March, 1983 and RANRL was included in the transfer. This was achieved by abolishing the relevant positions in Defence Support and re-creating them in Defence with the same designations, classifications, duties and locations. The occupants of these positions, including permanent and temporary officers and employees, were similarly transferred to Defence. Thus, there was little change to the day to day working arrangements. (The Department of Defence Support was officially abolished on 13 December, 1984).

A further major change occurred on 1 August, 1984 within the Weapons Systems Research Laboratory (WSRL) in Salisbury, South Australia. WSRL would now comprise four Divisions, and RANRL would be included in one of them. A new Division, entitled 'Maritime Systems Division' was created, comprising the existing RAN Research Laboratory, which at that time was still at Rushcutters Bay, and the Marine Studies Composite, which was part of the former Weapons Systems Division at Salisbury, SA. This new Division would be headed by the occupant of the then existing DRANRL post, to be re-titled 'Superintendent Maritime Systems Division' (SMSD). The two units concerned remained in their existing locations.

On 3rd November, 1984, the RANRL component of the Division commenced its relocation from Rushcutters Bay in the Sydney suburb of Edgecliff to the Royal Edward Victualling Yard (REVY) in the suburb of Pyrmont. The REVY building number 3 had been extensively refurbished as a research laboratory and this was the first time that the laboratory had had a high standard of accommodation and facilities purpose-built for RANRL.

As at November 1987, the Division comprised seven scientific groups practising a number of related disciplines, plus an engineering group. Administration was controlled by an administration officer Mr E.J. Huggett. The number of staff totalled 170.

As from 1 December, 1987 the staff of the RAN Research Laboratory was assimilated into WSRL and on instruction from the Chief Defence Scientist, "RANRL" ceased to exist.

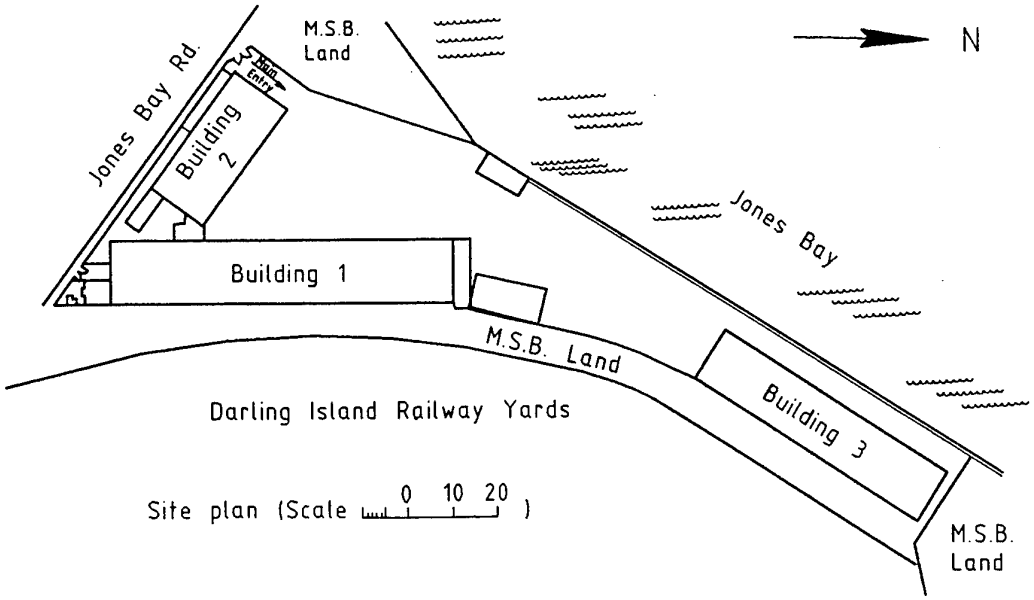
REVY SITE HISTORY

In its later years, the Laboratory occupied the Royal Edward Victualling Yard, located in the old inner city Sydney suburb of Pyrmont. Both the site and the REVY buildings have long been associated with the history of Sydney and Australia.

The site is part of the original 55 acre parcel of land granted to a soldier, Thomas Jones, on the 14 March, 1795. He kept the land for seventeen months, then sold it to Obadiah Ilkin who kept it from August 1796 to July 1799, when it was again sold to John Macarthur. In 1836 John Macarthur died and his son, Edward, inherited the land. In 1836 Edward decided to sub-divide the estate into fifty-nine lots.

In 1846 the Australian Steam Navigation Company (ASN) purchased the site and developed it as a shipyard. The ASN's first ship, BALLARAT, was launched from here in 1854. By 1887 the ASN yards covered six and a half acres and had a deep water frontage of over half a mile. The yards were sold in July 1895 to a private syndicate who in turn sold the land to the NSW Government in 1899. It was on this site that the REVY was developed.

According to Frame (1990), the Royal Navy realised that facilities at Garden Island were unable to cope with the activities of the Australian Squadron. The Commonwealth Government suggested that as the benefits of a Navy Victualling Store in Sydney would mostly flow to NSW, the NSW government should fund the new facilities for the Admiralty. This they did at a cost of £37,000. Royal permission to attach the name of King Edward VII to the establishment was given on 22nd January 1907.



REVY Site

When Sydney ceased to be the Headquarters of the Royal Navy Australia Station in 1913, the property was transferred to the Commonwealth in two parcels of approximately 1252.25 sq.m. and 4995.5 sq.m., it being agreed that both parcels be

provided free of charge as Transferred Properties. These two parcels of land, augmented slightly by some minor boundary adjustments in 1963, comprise the present Commonwealth holding. The Commonwealth Naval Board took possession of REVY on 1st July 1913.

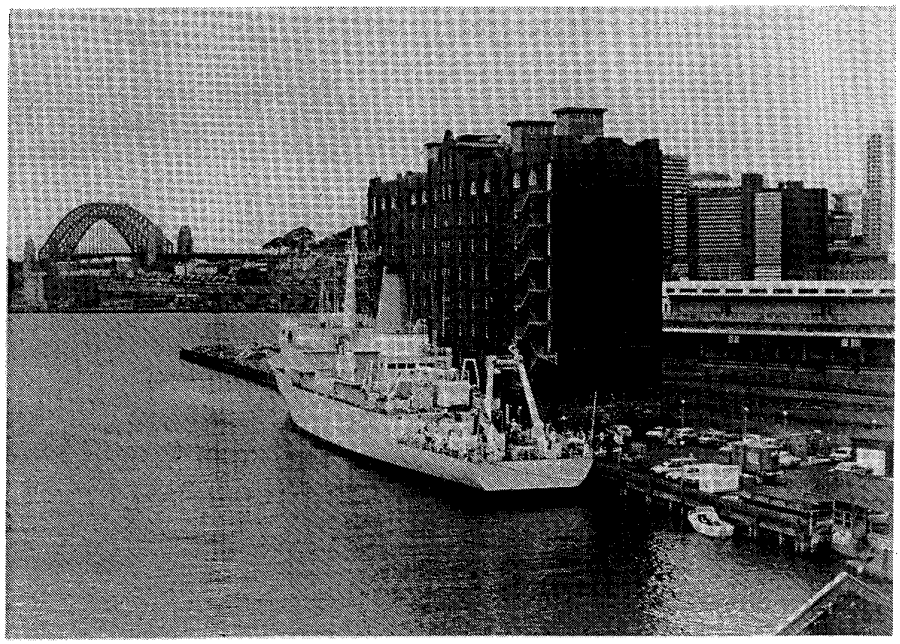
The existing accommodation consists of the following buildings :

Main Warehouse (Buildings No. 1 and 2)
This is a patterned red brick warehouse designed about 1910, comprising one 5 storey wing and one 6 storey wing, joined by a water tower of pseudo Romanesque design. The building is roofed with Marseilles patterned tiles.

Buildings 1 and 2 are architecturally interesting, because they have load bearing brick outer walls with cross wall divisions but have an internal structure of hardwood timber. Columns and bearers are of hardwood timber with cast iron bolsters. The columns are spaced four metres apart and have been designed for high (ie. warehouse) loading. Vertical access in both buildings is via stair and lift.

Buildings 1 and 2 were designed by the NSW Government Architect, Walter L. Vernon. They mark the early growth of the RAN and its provisioning facilities as distinct from its reliance on buildings erected during the colonial era.

Naval Stores Building (Building No. 3)



Building 3 at REVY with HMAS Cook alongside. The Sydney Harbour Bridge can be seen in the background.

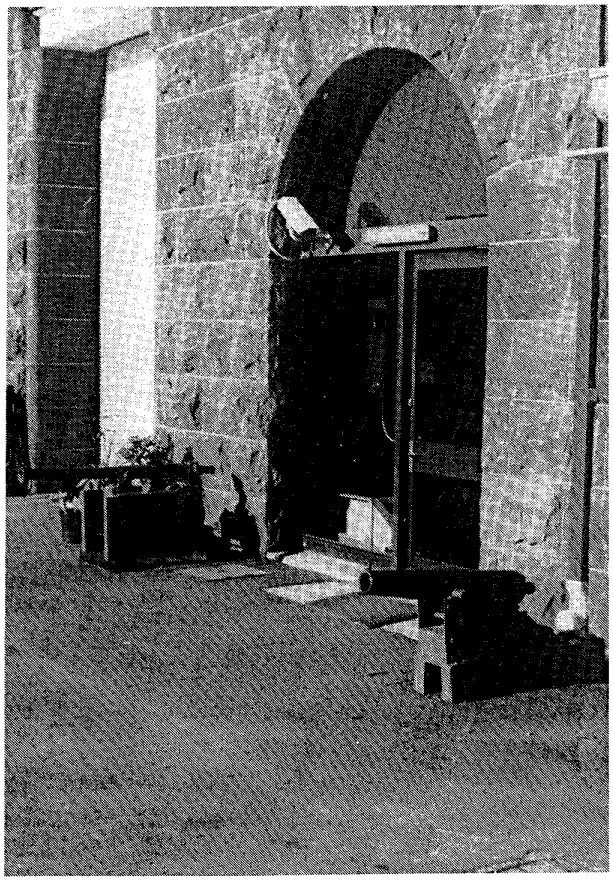
This building is eight storeys in height, clad in dark red bricks with Flemish gabled parapets and stone base. Built about 1915 to the NSW Government Architect's design, this is a good example of multi-level dockside warehouse architecture, which is rare in Australia. A line drawing of this building can be seen on the title page.

All buildings are included in the Register of the National Estate and "Classified" by the National Trust (NSW).

REVY building number 3 was extensively refurbished as a research laboratory and this was the first time that the Laboratory had high standard accommodation and facilities purpose built for research. There was also a deep water berth suitable for research vessels to come alongside. There had been no such deep berth available at Rushcutters Bay.

When the Laboratory moved to REVY it brought two historically important cannon to display at the main entrance to the Laboratory. Both of these antique guns are more then 100 years old and it is thought they were brought to Australia by the NSW Naval Brigade serving in the Boxer Rebellion.

One gun is a British RML (Rifle Muzzle Load) dated 1872 and the other, a swivel gun, is of South East Asian origin - possibly Indonesian. The wooden carriages are not originals. These guns are on display at the main entrance to DSTO Sydney at Pyrmont.



The two cannon guarding the entrance to the Laboratory at REVY.

NAVAL SCIENCE

The British Royal Navy has a long tradition of supporting the study of the oceans and naval science. Much of Australia's early history was influenced by the role the RN played in charting and understanding the waters of the world. The early development of oceanography in the days of Royal Navy sailing ships has been sketched in Jones and Jones (1992). The Hydrographer, RN performed the role of oceanographer, issuing instructions to ships on the measurements and methods to be used when cruising in distant waters.

Science was slow to develop in the rough society of early Australia. MacLeod (1988) traced this difficult start. While universities were established in the 1850's, a century before the RAN Research Laboratory was established, the research degree of Ph.D. was not awarded by the University of Sydney until five years before the formation of the Laboratory.

Even though it was encouraged by the British Admiralty, the establishment of an organisation with scientific research staff was a bold step for a small navy. As the organisation matured, it was for a long period one of only four government organisations in Australia with research scientists on its staff.

In the same years as the Naval Board established the RAN Experimental Laboratory, the CSIRO expanded its marine activities by appointing Dr George Humphrey as the Chief of a newly named Division of Fisheries and Oceanography. This division, based at Cronulla in the same city as RANEL, was to play an important role in the exploration of the oceans around Australia. The Navy made two frigates available for the CSIRO program.

While the two organisations followed their separate courses, a number of RANEL staff have been closely involved over the years with the CSIRO Marine Laboratories. Temperature data at different depths could be obtained by using a bathythermograph and these were deployed from the RAN ships. CSIRO organised storage of the output in the form of photographs. In the early 1960's the laboratory manually analysed such photographs but despite considerable effort, sample sizes remained extremely small. In the mid 1960's Julie Mäthenius worked intermittently with David Rochford and David Vaux to obtain their data and with a long term liaison with the Australian Oceanographic Data Centre, AODC, the situation improved. In another facet of oceanography Bruce Hamon provided early direction to Paul Scully-Power's work on the Coral Sea. Paul went on to be the first oceanographer to observe the oceans from space. The CSIRO's early years are reported in Mawson, Tranter and Pearce (1988).

At the Weapons Research Establishment a Maritime Systems Composite (MSC) was established under Henry D'Assumpcao, initially to develop the BARRA sonobuoy and later to work on towed arrays. RANRL cooperated with MSC when there were common interests and in 1984 RANRL and MSC were organisationally combined into a Maritime Systems Division at WSRL. Henry D'Assumpcao went on to become the Chief Defence Scientist.

Cooperation with universities commenced with Project BUMP described on page 45. Summer students provided another link with universities, and many successful staff members have been introduced to the laboratory by this device.

Not only was there local cooperation, but there were also frequent exchanges with defence science organisations in USA and the UK. As mentioned earlier, the initial training for some RANEL staff was in the UK. Later, exchanges with the US became common as well. These exchanges and long term visits brought many benefits. They were not confined to just science. Eric Kaye's visit to the US Naval Research Laboratory to work on the deep water engineering project SEA SPIDER in 1967, for example, led to many future exchanges of technology.

During its first decade, the RAN Experimental Laboratory operated with considerable secrecy, a tradition inherited from its early associations and support from the British Admiralty. However, as more people with experience in other science organisations joined, events such as regular seminars and presentations at conferences became more common. In November, 1973, Marshall Hall organised an open meeting of scientists from Australia and New Zealand to exchange ideas common to acoustics and radar propagation. The Laboratory began to play a role in international science. Some staff members were awarded honours by professional societies. Doug Cato, for example, was elected a Fellow of the Acoustical Society of America.

In the classified arena, The Technical Cooperation Panel, TTCP, provided a valuable forum for the exchange of ideas and technology amongst US, UK, NZ, Canadian and Australian scientists. There were a number of subgroups who met regularly and on many occasions at the Laboratory. Australian research and development efforts showcased at these panels were often well received. For example, Brian Wild was given an achievement award for collaborative studies on anti-submarine warfare which showed the value of tactical towed arrays for surface ships.

RANRL GROUP HISTORIES

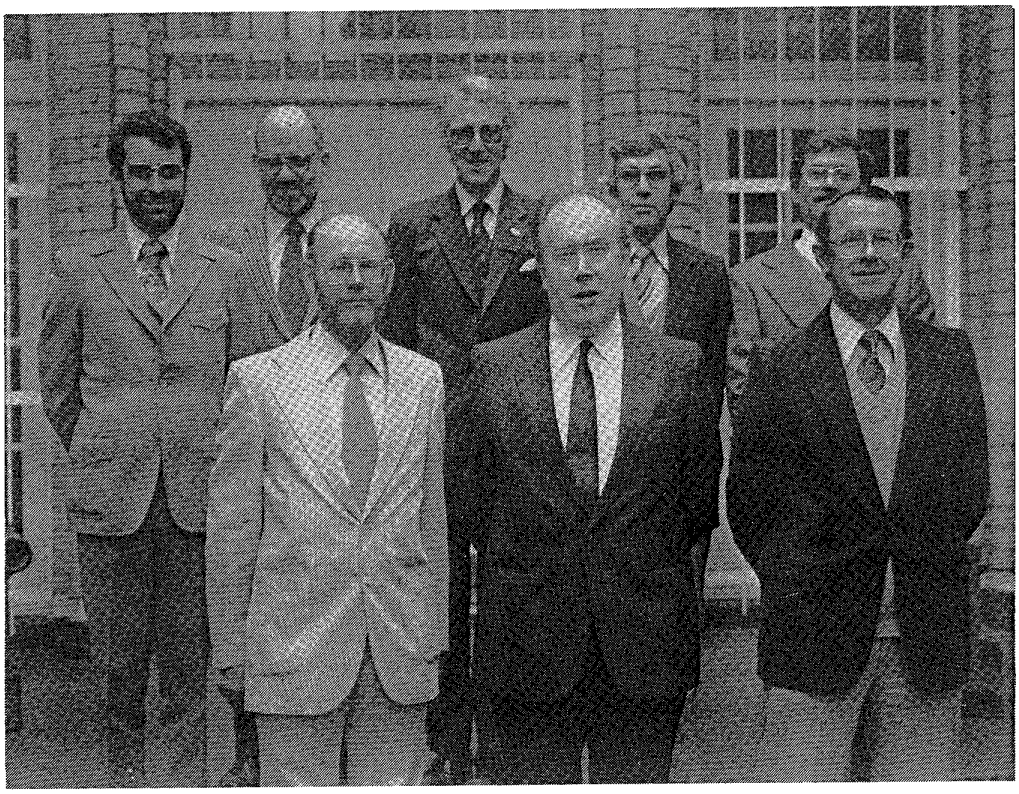
Scientific Group Development in RANRL

From 1956 to 1965 laboratory scientists and technical staff were involved in a large number of experiments, trials and projects of which some were of major proportions, such as Project EDMONDS, and some were less complex although still of significant defence importance. A wide range of scientific and technical disciplines were encompassed and in October 1965, in conjunction with a further staff increase, RANRL was reorganised into three major scientific groups as described on page 12. These groups consisted of the Underwater Physics Group (Head, W.F. Hunter), Operations Research Group (Head, M.W. Buckham) and the Fluid Mechanics and Underwater Weapons Group (Head, W.J. Turner), supported by an Engineering Services Group (Head, E. Kaye). The Fluid Mechanics and Underwater Weapons Group was retitled Underwater Weapons Group in 1969 and in 1970 a further name change was made to the Mine Warfare Group. W.J. Turner remained Head.

In the late 1960's the research scope of the Underwater Physics Group broadened to include sonar systems and sonar signal processing and eventually a Sonar Group was formed from members of the Underwater Physics Group in 1971. The existence of the Sonar Group, with J.C. Waller as Group Head, was formalised in early 1973, when the Underwater Physics Group was split into an Ocean Sciences Group and the above mentioned Sonar Group. The initial Group Head of the new Ocean Sciences Group was I.S.F. Jones. Further expansion occurred later within the Sonar Group, which assumed additional responsibilities, and the name was amended to Sonar and Surveillance Group.

Thus, just prior to the DSTO reorganisation on 1 December, 1987 the groups at RANRL were:

Operations Research	(Head, Mr M.D. Frost)
Mine Warfare	(Head, Mr W.J. Turner)
Ocean Sciences	(Head, Dr. M. Hall)
Sonar & Surveillance	(Head, Mr J.C. Waller)
Engineering	(Head Mr C.A. James)



Group Heads 1982

BACK ROW (l to r)
Mr Chris L. Charnas (Administration)
Mr Warwick J. Turner (Mine Warfare)
Mr John C. Waller (Sonar and Surveillance)
Dr Ian S.F. Jones (Ocean Sciences)
Mr Charles A. James (Engineering)

FRONT ROW (l to r)
Dr William F. Hunter (Director RANRL)
Mr Charles C. Halton (Secretary Department of Defence Support)
Mr Maurice D. Frost (Operations Research)

Operations Research Group

The Operations Research Group was formed with two people, M.W. Buckham and M.D. Frost. When the RAN Research Laboratory was subsumed in 1987, Morry Frost was the Group Head. The activities of the group commenced with the assessment of anti submarine warfare (ASW) escort requirements for the RAN. Quickly the group moved to conducting "hot wash-ups" (assessment immediately after an exercise, before detailed analysis) for naval exercises, the first being Exercise TUCKERBOX in 1961.

By 1964, a distinctive approach to Operations Research had begun to evolve. This was both in studies and exercise analysis, based on the important principle that models used in studies must be well supported or, hopefully, validated by data obtained from research investigations and from exercise analysis.

Between 1964 and 1967 studies and exercise analysis continued, culminating in two 'order of battle' studies for the Naval Staff, encompassing most types of units in the Navy.

The 'order of battle' studies indicated a need for in-depth assessments across the whole field of naval warfare, not just restricted to ASW as nearly all previous Operations Research work by RANRL had been.

Next followed the detailed analysis of Exercise CORAL SANDS, possibly the largest and most realistic exercise RANRL was associated with. It was important not only for the value of the analysis results, but also for its value in crystallising ideas on the future path to be taken for the automation of exercise analysis.

The Destroyer Study occupied much of the Group's effort between 1969-71. This was one of the main bases for the Navy development of the Australian light destroyer concept (later to be replaced by the FFG acquisition). The study was the first RANRL attempt to examine virtually all the operational tasks for a class of ship and thus represented a step forward in the development of technique. Also during this period, the need was recognised for people to become specialists in certain areas and the general framework of the Group emerged from this time. Four sections evolved: submarine and ASW studies, above surface studies, exercise analysis and war studies (ie. broader force matters).

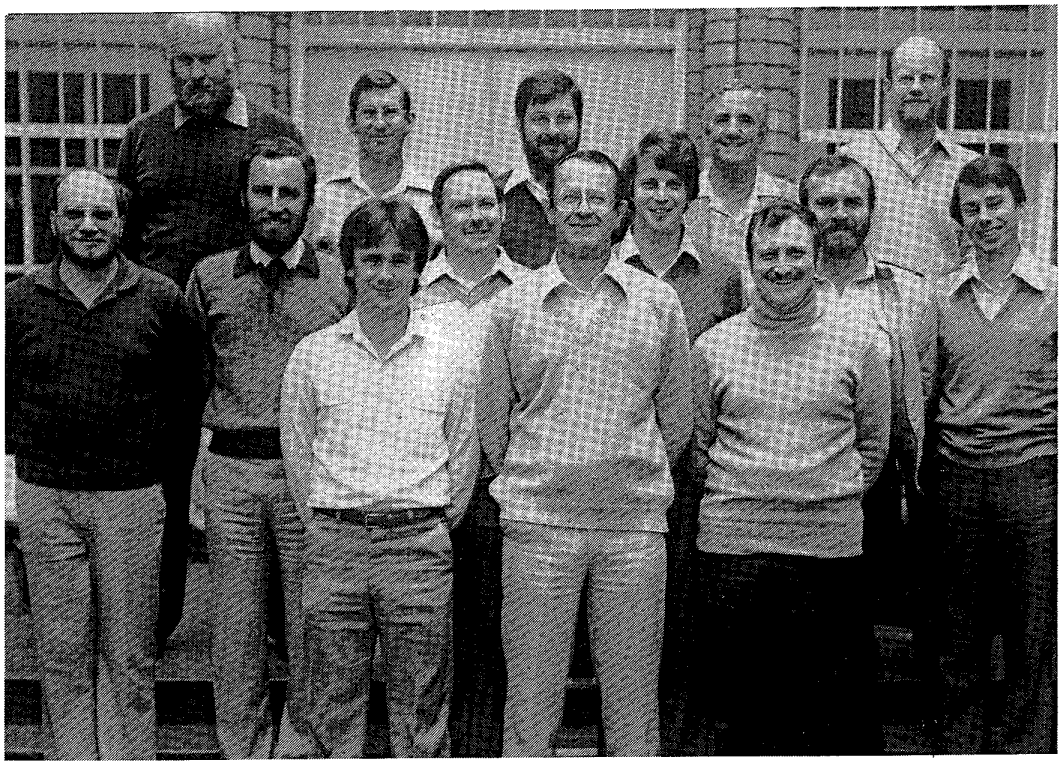
By the mid seventies, the Group had expanded to 19 people and a variety of small and large tasks had been completed - these included the Patrol Craft study and the completion of the analysis of the 1971 AAW (anti air warfare) exercise and the OPEVAL for the AN/AQS - 13A dipping sonar. (These were the first Naval exercises in which RANRL played a major design role). Julie Tonurist was the laboratory's coordinator of the AQS-13 operational evaluation and went to sea in HMAS Vendetta (commanding officer M.W. Hudson) with the permission of the Chief of Naval Staff and flew in Wessex helicopters, paving the way for future female laboratory staff to participate in naval exercises. New methods of estimating propagation loss were developed and during this period the exercise analysis automation was used in a major way for the first time. Sound recordings via the Oberon submarine's passive sonar, properly calibrated before the exercise provided the raw data.

The main tasks completed between 1977 and 1981 were a wide-ranging investigation of Australia's requirements for ASW forces in the 1990's, time frame, development and

assessment of mathematical algorithms for the RAN submarines and a new fire control system and further work in the Exercise Analysis Automation Project. Major tasks in the early 1980's included the detailed analysis of exercise SANDGROPER 80 with primary emphasis on the capabilities of automated combat data systems in air defence and several studies in the ASW and AAW fields.

Between 1979 and 1984 the Group was particularly concerned with the provision of information and advice (from then-current and previous studies and exercise analyses) for use in a concentrated period of Navy and Defence decision-making on major re-equipment proposals, including the aircraft carrier, P-3 aircraft upgrade/replacement, additional FFG class ships, new submarines and the FFG helicopters (Seahawks).

Much of this work involved the detailed assessment of sensor, fire control and weapon system options, one example being the potential of various towed array sonar systems. Studies of tactical and surveillance towed arrays and some exercise analysis in this area led subsequently to the Group's leadership (between 1983 and 1986) of a large scale international study concerned with towed arrays and related systems and platforms.



Operations Research Group 1982

BACK ROW (l to r) : J. Mentjox, R. Ivory, P. Polec, H. Pillow, B. Wild
CENTRE ROW (l to r) : M. Katz, J. O'Neill, G. Williams, S. Craig, P. Williams, M. Burgess
FRONT ROW (l to r) : J. Krisenthal, M. Frost, J. Andrews

(Absent : G. Searle, N. Anderson, R. Wong, M. Battaglia)

Other work in the period up to the end of RANRL as a separate Laboratory, in 1987, included the development of a suite of detailed detection and weapon system models for use in a variety of studies. These models, mostly computer-based, typically give considerable attention to the physics of the situation being modelled, particularly the

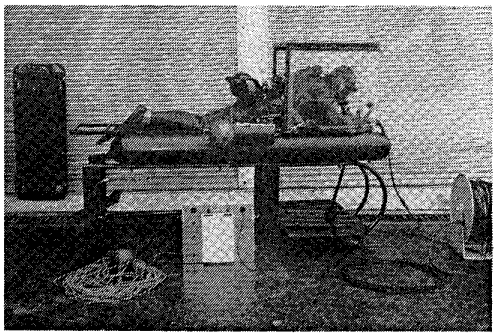
environmental effects, and also to the real-world factors as determined often by exercise and other operational analyses. The Group by now had well-developed models of passive and active sonars, radars and other sensor types, as well as models of various fire control and weapon systems. These models have been applied in studies such as those providing information for use in the New Surface Combatant (now the ANZAC ship) project and in studies of the way ahead for sonobuoys and towed arrays.

As part of the DSTO re-organisation in 1987, the Operations Research Group was incorporated into the Combat Systems Division of WSRL. Importantly, its close relationship with the Services, particularly the RAN, has been preserved and the Group continues to be heavily involved in studies related to re-equipment proposals and tactical development and in the evaluation of systems at sea under realistic operational conditions.

In 1982, the Group Head, Morry Frost, was appointed as a member of the Order of Australia for his services to the RAN.

Mine Warfare Group

Starting under the name Fluid Mechanics and Underwater Weapons, the Mine Warfare group concentrated on clearance diving during its early years. Commencing in 1957 two staff developed the Divers Underwater Glider shown below that allowed a diver to be towed over the sea floor by a boat for visual detection of mines.



Underwater glider developed by the Mine Warfare Group.

A study of countermeasures against underwater saboteurs in 1963 led to the 'half necklace' search for ships bottoms, and a towed obstruction deterrent used in the Vietnam War. In 1965 a mine identification system was designed.

MINE COUNTERMEASURES DEVELOPMENT UNIT, 1961
BACK ROW (l. to r.) : G. Gardiner (RANEL), N. Jeffries, N. Hill, P. Egan, W. Turner (RANEL)
FRONT ROW (l. to r.) : P. Pugsley, S. Brennan.

A series of multi national mine countermeasures (MCM) exercises was observed and analysed during this period to provide a realistic data base for later MCM studies. Active participation in the TTCP Mines and Mine Countermeasures Panel (G-6 and later GTP-13) commenced in 1967 and has been continuous to the present day. Two multi national trials with the US and UK were held in NSW in 1977-78.

A change in emphasis occurred in 1968 with the commencement of studies of the mine threat. The group established a general reputation for magnetics research, broadening to include projects not directly related to MCM including a study of the reduction of magnetic compass errors in RAAF Mirage III fighters (1971 - 73), and an investigation of techniques used for reducing alternating magnetic fields in the electron microscope room at the Sydney Eye Hospital (1973 - 75).

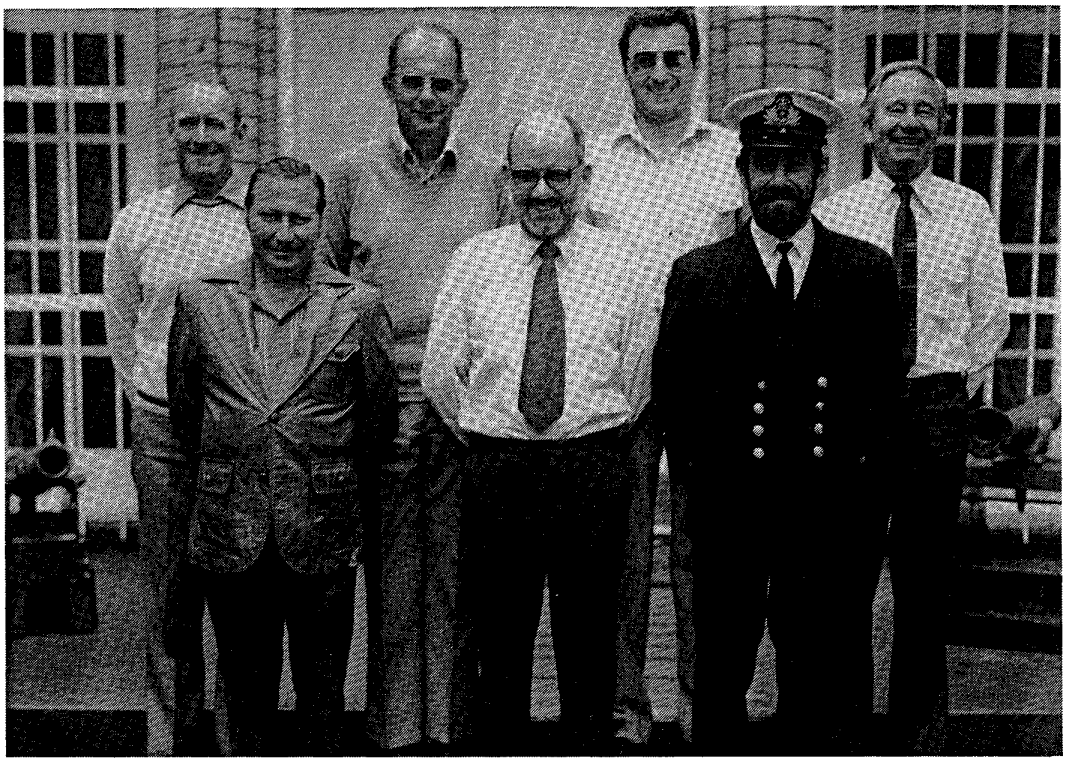
Research into a towed permanent magnet for sweeping magnetic mines, commenced in 1973. Warren Hill designed a towed magnet which was developed into operational magnetic sweeps for the RAN. The development of a magnetic facility for measuring the extremely low magnetic field of Clearance Diving equipment was carried out during 1973 - 75.

A series of studies commenced in 1971 to assist naval staff in the selection of MCM vessels to replace the TON class minehunters and minesweepers. Australia's requirements for naval mining were examined in 1980 and, amongst other results, led to the RAAF acquiring mine mechanisms. An extensive survey of the mine warfare environment was commenced in 1972 and special laboratory equipment developed to physically recreate the environment.

The group participated in a TTCP working group established in 1980 to study the

reduction of the mine threat to targets by self protection (passive MCM). The activities of the TTCP working group on passive MCM came to a satisfactory conclusion in 1982 and G. Lockey and G. Saiva received TTCP awards.

During 1982 - 84 the group expanded from the seven people shown here to eleven personnel.



Mine Warfare Group 1982

BACK ROW (l to r) : J. Hibbert, G. Saiva, S. Valentine-Flint, R.B. Jones
FRONT ROW (l to r) : W. Cheetham, W. Turner, LCDR P. Hermans

(Absent : G. Lockey)

Following a series of RANRL studies and proposals a task was initiated in 1984 to develop equipment to enable Craft of Opportunity (COOP), such as fishing vessels and tugs, to be rapidly converted into minesweepers and/or mine surveillance craft. The group participated in a multi national magnetics trial in Sydney in 1987.

Ocean Sciences Group

The Ocean Sciences Group, the youngest of the laboratory's research groups, was officially formed in 1973 from the long standing Underwater Physics Group. The initial complement of the new group was 12, with Dr Ian S.F. Jones as group head. Previous Underwater Physics research programs in acoustics and oceanography were continued and new activities were added.

The group investigated volume and sea floor acoustic backscattering, propagation in the ocean surface duct, limitations of geometric acoustic propagation for long ranges, and the caustics that are formed in duct propagation. These acoustic topics all relied on a description of the medium in which the sound travelled and so series of measurements were made from HMAS Diamantina and HMAS Kimbla to determine the temperature, salinity and speed of sound in selected areas of the ocean around Australia.

Satellites provided a new technology for sensing the ocean on a large scale and Paul Scully-Power and Carl Nilsson exploited this technology to study the meso-scale eddies and general surface climatology of the oceans east of Australia. From this program came the RAN operational system of synoptic ocean maps of the East Australia Area.

Paul Scully-Power

By 1980 the number of positions in the group increased from 12 to 17 as a result of several vacant oceanographic positions being transferred from the Marine Studies Composite at Salisbury. Underwater Acoustics research being undertaken included propagation modelling using normal-mode theory, surface scattering, and sea noise (particularly of the low-frequency wind-generated type). Oceanographic research comprised mixed-layer deepening (laboratory and sea experiments), near-surface transient heating ("afternoon effect"), and oceanic microbubbles. A meteorological study of the formation and climatology of advective and evaporative radar ducts was also conducted. HMAS Diamantina, which had been used in much of the field work, was decommissioned in 1979.

During 1983 the group's establishment increased to 21 with the creation of a Geo-acoustics cell. Other notable events were the decommissioning of HMAS Kimbla in 1984, and the group's first ocean surveys using the RAN's new oceanographic vessel HMAS Cook. The effective deployment of this new vessel was to consume much of the group's resources and Barry Scott took on the task of co-ordinating this effort.

The first survey of the new SEAMAP project was conducted during early 1984. The purpose of this major task was to compile a data bank on the acoustical and oceanographic parameters that affect sonar performance along Australia's deep-ocean trade routes. This project was a contribution to Australia's responsibilities associated with the Radford-Collins Agreement for the protection and control of shipping in the event of global conflict.

During the first ten years, the group had added a new dimension to the laboratory's capabilities by publishing 66 papers in the international literature. It had also provided resources to international experiments such as the Joint Air Sea Interaction experiment, JASIN, conducted in the North Atlantic.

Ocean Sciences Group 1982

BACK ROW (l to r) : J. Boyle, L. Hamilton, D. Cato
CENTRE ROW (l to r) : P. Mulhearn, I. Jones, A. Duffy, M. Lawrence, W. Hill
FRONT ROW (l to r) : F. Bruzzone, N. McKillop, A. Quill, F. Di Francesco

(Absent : S. Pascoe, B. Kongas, P. Tyldsley, M. Hall)

The scale of the problem of understanding the oceans around Australia and the capability made available by HMAS Cook stretched the resources of the expanded Ocean Sciences Group. In 1983, the Chief Defence Scientist, Tom Fink, reached an agreement with the Vice Chancellor of the University of Sydney for the formation of an Ocean Sciences Institute to be managed jointly via a council that reported to the University Senate. The first director was Dr Gordon Packham who had collaborated with the Ocean Sciences Group in the past.

This experiment in joint management and support of an external institute was very successful, leading to 39 scientific papers and reports in the first three years. It also published five maps as part of a series of acoustic and bathymetric properties of the sea floor.

During 1986 Dr. Jones stood down from the Group Head position and was replaced by Dr. Marshall Hall who made a change in the direction of the group. The effort on fluid-dynamical studies in tanks was phased out in order to concentrate resources in other areas. Projects with an atmospheric or electromagnetic application, such as radar ducting, were also phased out since other groups such as the Electronics Research Laboratory and CSIRO had better facilities and background to investigate these topics than this group. The group attempted to hire the skills of researchers in tertiary institutions, rather than support and encourage them as it had through the Ocean Sciences Institute. Research objectives were chosen primarily to match defence priorities rather than to exploit the resources available. Providing a program for HMAS Cook had strained the resources of the group and led to this shift in philosophy.

As at the 30 November, 1987, the Ocean Sciences Group consisted of nine professional and eight technical staff.

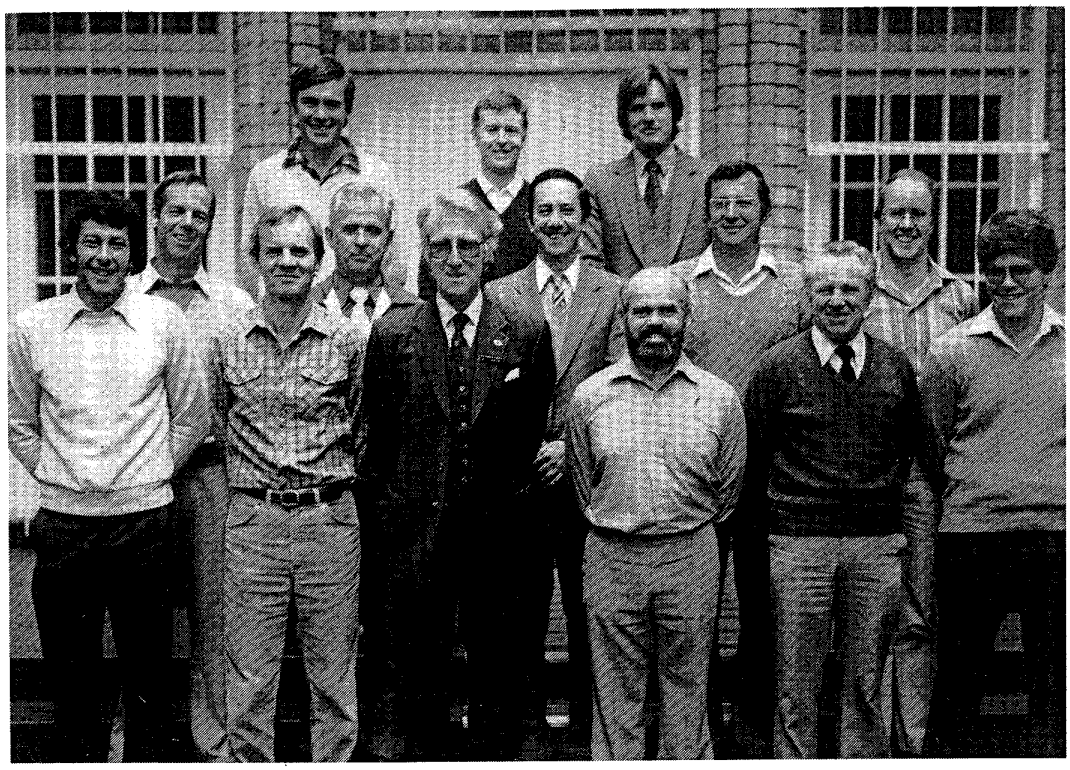
Sonar and Surveillance Group

A Sonar Systems Section was formed within the Underwater Physics Group in 1971 and was headed by Mr J.C. Waller supported by J.L. Thompson and I.A. Hagan. Ian Hagan went on to become the Naval Scientific Adviser in Canberra and later Chief of the DSTO division that carried on the functions of RANRL

In 1971-72 the Sonar Systems Section expanded to a total of six professional staff. The major areas of research addressed during this period were development of the sonar system MULLOKA, sonar displays and automation, sound propagation, interference by active sonars with the Mk 46 torpedo, submarine passive sonar, the FANWISE sonar and a signal processing study related to hydrophone arrays.

A separate Sonar Group was formed in early 1973, when the Underwater Physics Group was officially split into an Ocean Sciences Group and a Sonar Group. Sonar Group strength was then fifteen, made up of Mr J.C. Waller as Group Head and fourteen staff, including one psychologist and one United States exchange scientist.

Research widened in 1973 and included areas such as torpedo sonars, submarine sound ranging, acoustic intelligence, environmental studies and bottom bounce sonar performance. By 1978, the sonar development project MULLOKA had been substantially completed but support in this area continued for several more years.



Sonar and Surveillance Group 1982

BACK ROW (l to r) : R. Hickson, L. Criswick, J. Uusioja
CENTRE ROW (l to r) : A. Latham, L. Schwertner, J. Thompson, R. Wyber, G. Speechley
FRONT ROW (l to r) : M. Valentine, M. Bell, J. Waller, A. Collins, J. Johnson, A. Thompson

(Absent : D. Wyllie, M. Shelton)

In 1979 the Group was renamed the Sonar and Surveillance Group in anticipation of commencing towed array research, the long term aim being to form two separate groups called respectively Sonar and Surveillance. The major Group activities were Defence Trial ARMORIC (the evaluation of the submarine weapon update program in HMAS Oxley) and a program to improve the performance of a submarine sonar. For the latter program an innovative general purpose sonar signal processor was developed by Dr Ron Wyber, the son of the first superintendent of RANRL.

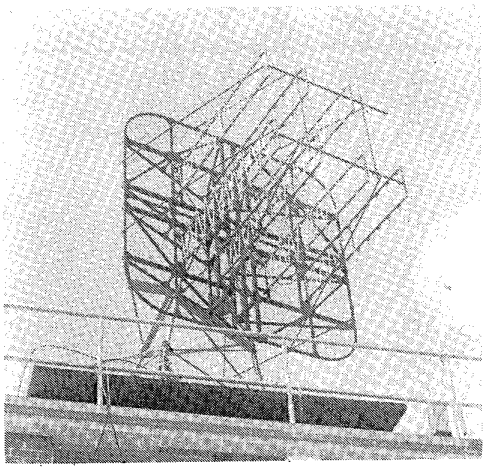
By September, 1982, the Group was involved substantially in submarine sonar work, including passive ranging techniques, target motion analysis, sonar classification, and intercepted active sonar interpretation. Non submarine oriented work included the study of anomalous absorption in sound propagating just below the sea surface.

Engineering Group

Engineering personnel were required at the laboratory from its inception. Eric Kaye, MIEAust, was appointed senior engineer within the first year of the laboratory's existence. Initial work was based on the needs of Project EDMONDS to deploy hydrophones and correlate their outputs. The development of ocean engineering technology continued to be the focus of this group.

Frank Harper and George Ellis in the Electronics Laboratory, 1959.
(Partitioning and office accommodation were later installed.)

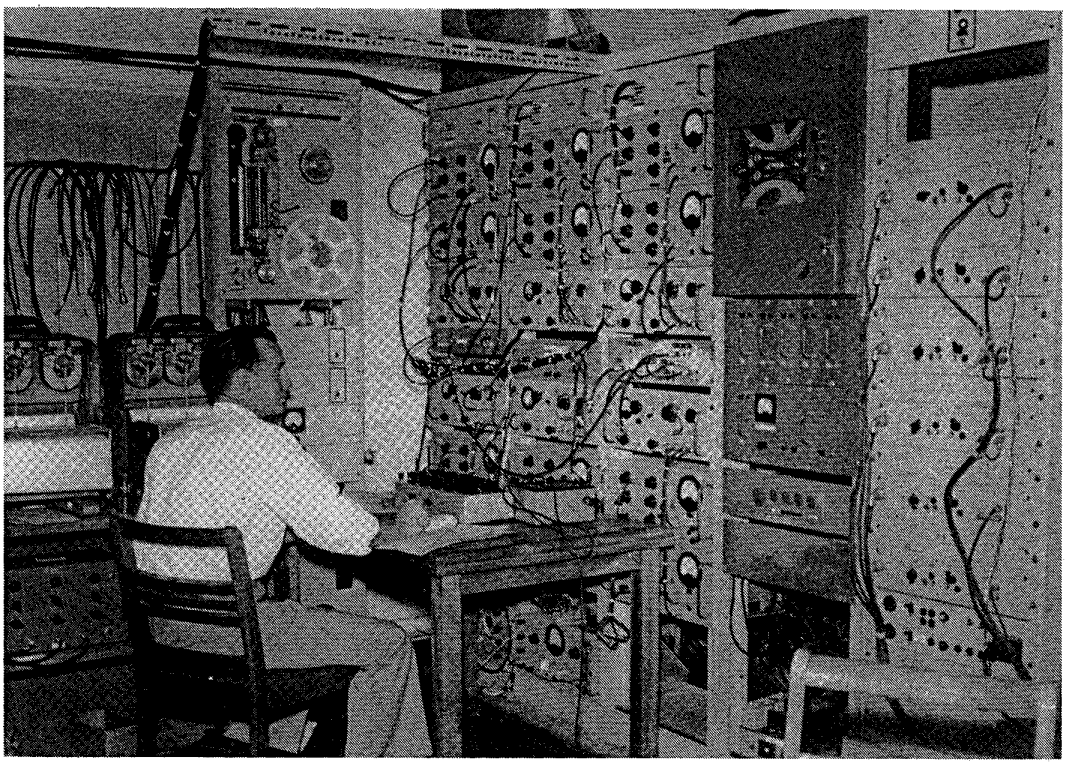
The design, production and purchasing of the hardware required by the Laboratory for its scientific research progressed during the period 1956 - 1964.
Electronics engineering personnel during this period were involved in an attempt to develop RATEL, a UHF telemetry link from a buoy to allow more reliable transmissions from hydrophones to distant shore stations. Development costs overran resources estimates and the system was not complete when project EDMONDS was completed in 1965.



RATEL (RANRL Automatic Telemetry Link)
Receiving Aerial on the roof of the South Building at Rushcutter. It operated on 400 MHz.

The electronics section also provided an input into the supervision of a UK contract to install an Anti Submarine Universal Attack Trainer (ASUAT) at HMAS Watson between 1957 - 1961.

Other examples of early projects were the successful development of the RANEL Automatic Correlation Equipment (RACE - an early example of a digital correlator beamformer used for analysis of EDMONDS data), IKARA targets, submarine sound ranges at Montague Island and off Jervis Bay and the Bass Upper Mantle Project (BUMP), a large scale off shore seismic experiment aimed at studying the Earth's crust and upper mantle in Bass Strait. It was done to assist the Geophysics Group of the Australian Institute of Physics as an extension of research of the 1965 International Geophysical Year. Here the laboratory was assisting the wider scientific community.



Noel Powell in the analysis laboratory using the CORSAIR correlator. This device was replaced by RACE.

Work load and staff increased during the period 1965 - 1970. Development of instrumentation for sea experiments was a continuing requirement. Equipment such as deep sea electric cable and cable connectors, oceanographic winches, sea noise buoys, data loggers, velocity temperature depth probes and correlation function computers were adapted and developed for RANRL requirements. Expertise in laying submarine cables associated with temperature, current and acoustic sensors was progressed (Project BARRABOOL and submarine sound ranges) and a small lightweight passive sonar was developed for minor war vessels (Project FANWISE). The responsibility for ship noise and radiated noise measurements was continued until January, 1967, when these duties were assumed by RANTAU.

The 1970's saw a continuation of submarine cable and temperature, current and acoustic sensor work associated with Project FLOWERLESS, a major study of fixed acoustic detection systems for submarines. The drawing office under Brian Bevan contributed much to this project and to the design of equipment and instrumentation for all other groups.

In September, 1982, the Engineering Group consisted of 24 personnel (7 professional and 17 technical grades). The Group Head was Mr Charles James. Major projects included the laying of a deep submarine sound range off Jervis Bay, design work on a joint RANRL/CSIRO drifting, satellite-tracked, instrumented buoy, and the feasibility study of a ship-towed acoustic source.

Engineering Group 1982

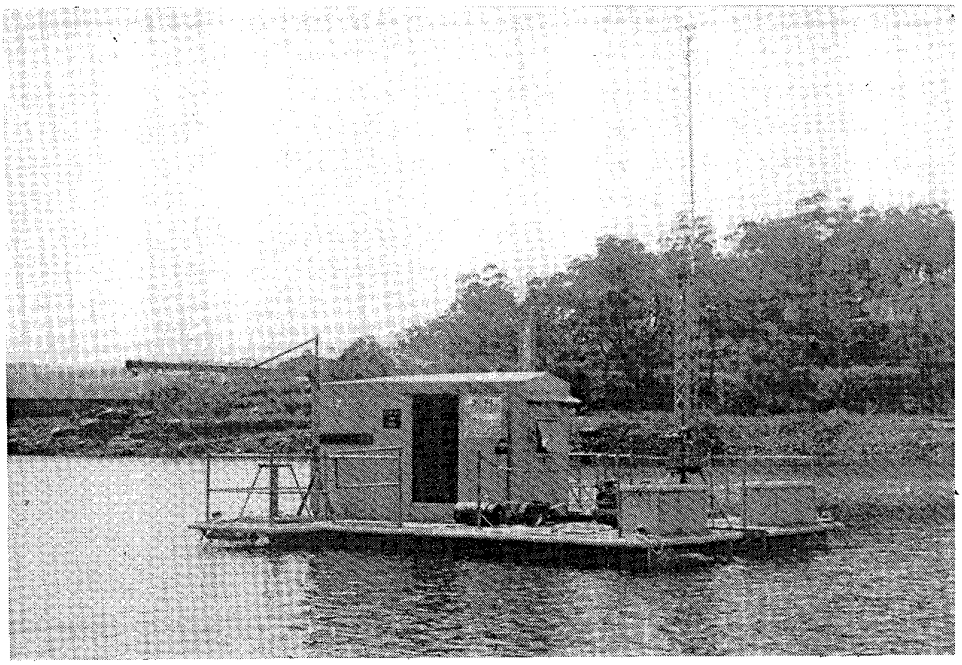
BACK ROW (l to r) : M. Savage, P. Oakman, D. Robinson, D. Bellgrove, I. Coote, G. Sinclair, N. Daly, R. Andrews, J. Huggett
CENTRE ROW (l to r) : A. Duff, G. Maskell, A. Duffy, J. Shaw, M. Kapp, N. Miles, S. O'Brien
FRONT ROW (l to r) : P. Vlaming, T. Hindle, C. James, R. Willstead, J. Tapia
(Absent : B. Bevan, G. Gardiner, M. de Sousa, F. Harper, B. Jones)

FACILITIES

Calibration Facility at Woronora Dam

RANRL maintained a calibration facility (pontoon) at Woronora Dam, south of Sydney, primarily to provide a stable platform in deep water and a quiet environment from which to calibrate hydrophones.

The pontoon (named "NORABEL", a combination of Woronora and decibel) was built and launched in the mid sixties, and in the late seventies underwent a major refit. The facility is the only one of its type in Australia. Hydrophones accurately calibrated on the facility are used in RANRL experiments to measure the absolute sound levels at sea.

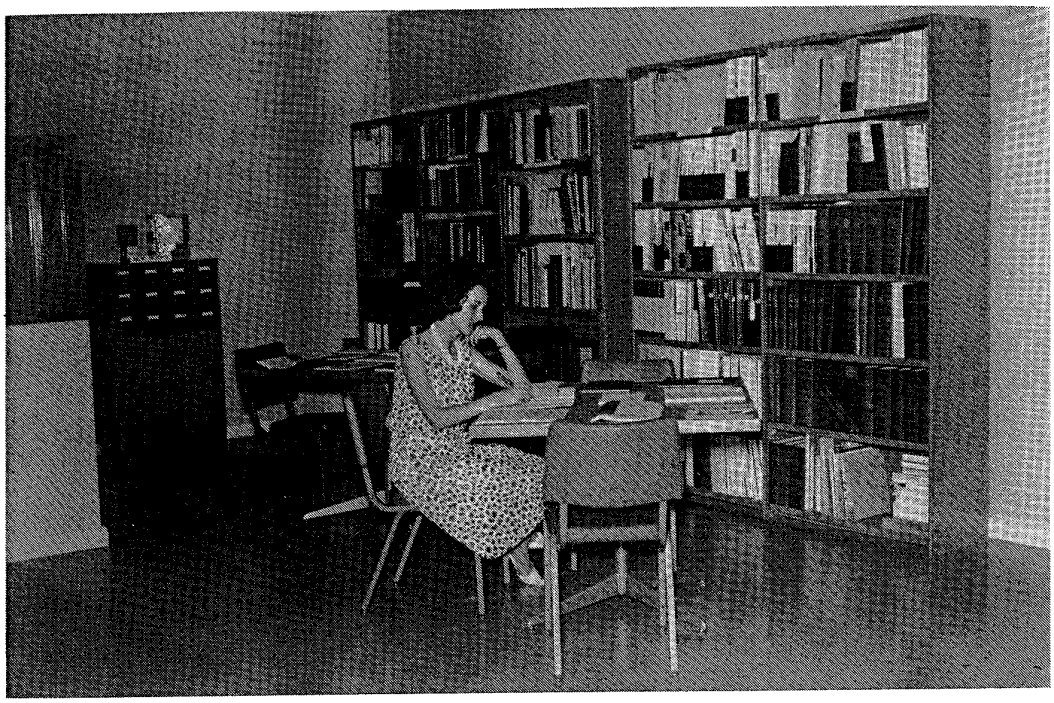


Calibration Facility moored on Woronora Dam

Library

The Laboratory started a collection of books and journals with the classified material kept in a vault, but with its growing activity quickly saw the need for a specialised library to support its research and trials work. It was necessary in 1960 to appoint Maureen Swords as a library officer to look after the holdings and in 1965, Pam Haythorn introduced a specialised index system. Margaret Barnes was in charge of the library for several years until Peggy O'Brien was appointed as the first university trained librarian.

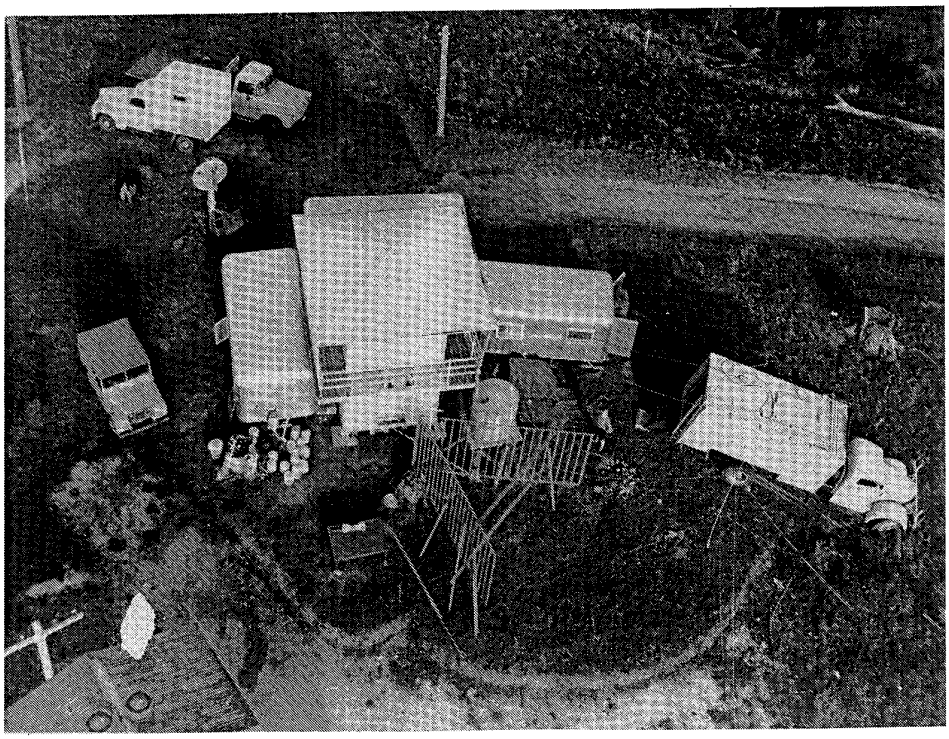
In its early days, the library had little interaction with other defence research libraries. When Australia joined the TTCP in 1967, it had increased access to US and Canadian reports. In 1977 the RANRL library became part of the Defence Information Services Branch. Further integration into the Defence library network provided more services such as on line searches of literature databases. By 1987, a good specialised library had been developed with an impressive holding of 10 500 reports.



The Rushcutter library after it had moved to the new extension of the South (Sayonara) Building

Mobile Shore Station

The original concept for Project EDMONDS was for the hydrophone signals to be telemetered from a buoy to a mobile shore station. The UHF telemetry link RATEL was not developed in time to use it in the EDMONDS experiments but the rest of the system was tried by deploying hydrophones from Kimbla and telemetering the signals ashore using sonobuoy transmitters. The receiving equipment was set up in caravans towed to the shore station at Mount Yarrahapinni.



Mobile shore station at Yarrahapinni December 1959. The structure in the foreground is a corner reflector to enhance the VHF reception from buoys in the Tasman Sea off Smoky Cape in northern NSW.

Montague Island
Acoustic experiments (including sound ranging of submarines) in the Tasman Sea were conducted by running hydrophone cables from deep water to shore on Montague Island. instruments were set up initially in a disused stable borrowed from the light house service. Later a substantial laboratory was built and a separate hut constructed for living quarters. These huts were removed when RANEL experiments ceased there.

Christmas Island
In order to support the large effort in acoustic research and oceanography in the Indian Ocean in the 1970's, the Laboratory developed facilities on Christmas Island. The work done on Christmas Island was a further development of the experiments conducted earlier at Montague Island. The British Phosphate Commission provided the accommodation for RANRL staff and research vessels were able to moor at the company's buoys.

Eric Kaye spearheaded the development of facilities and the laboratory on the island was affectionately named after him.

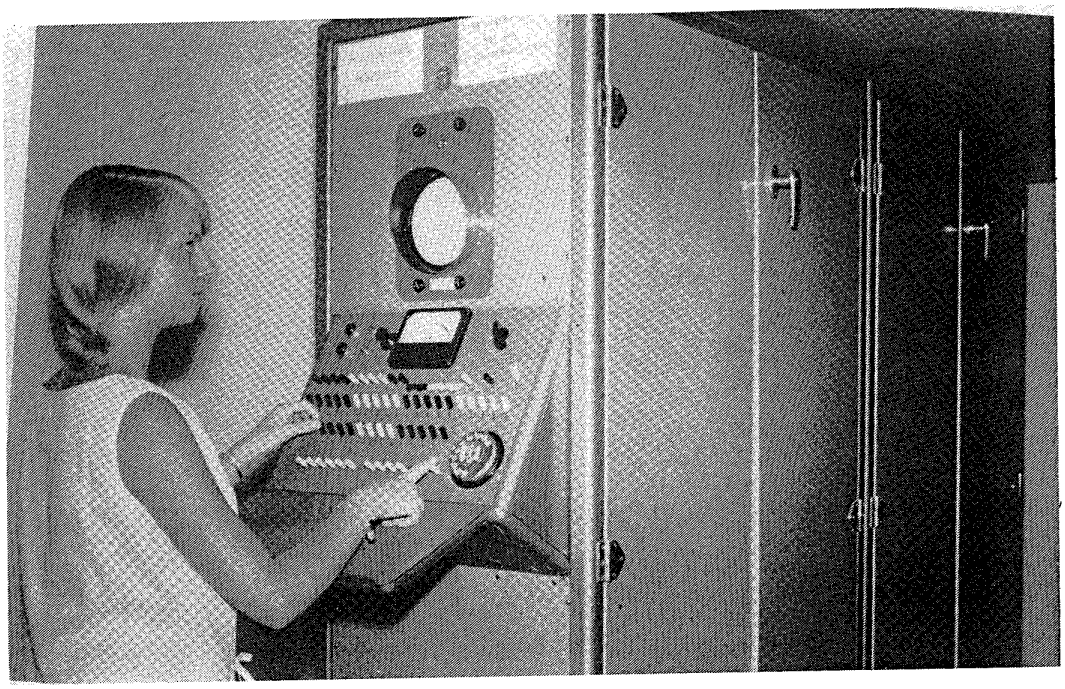
Fort Kaye on Christmas Island

BACK ROW (l. to r.) : Paul Nysen, Frank Harper, Mick Millington

FRONT ROW (l. to r.) : Brian Jones, Dick Sneesby, Ian Jones, Alan Latham

Computers

Research has increasingly relied on computers to provide the quantitative underpinning of scientific discoveries and policy advice. The Laboratory was a leader in computational support with the first digital computer obtained in 1963.
A room sized computer, the STC (Stantec) Zebra, was installed by Alan Thompson and Egon Tonurist. In those days, special air conditioning for the valves and a special motor generator for isolating the electric power were needed.

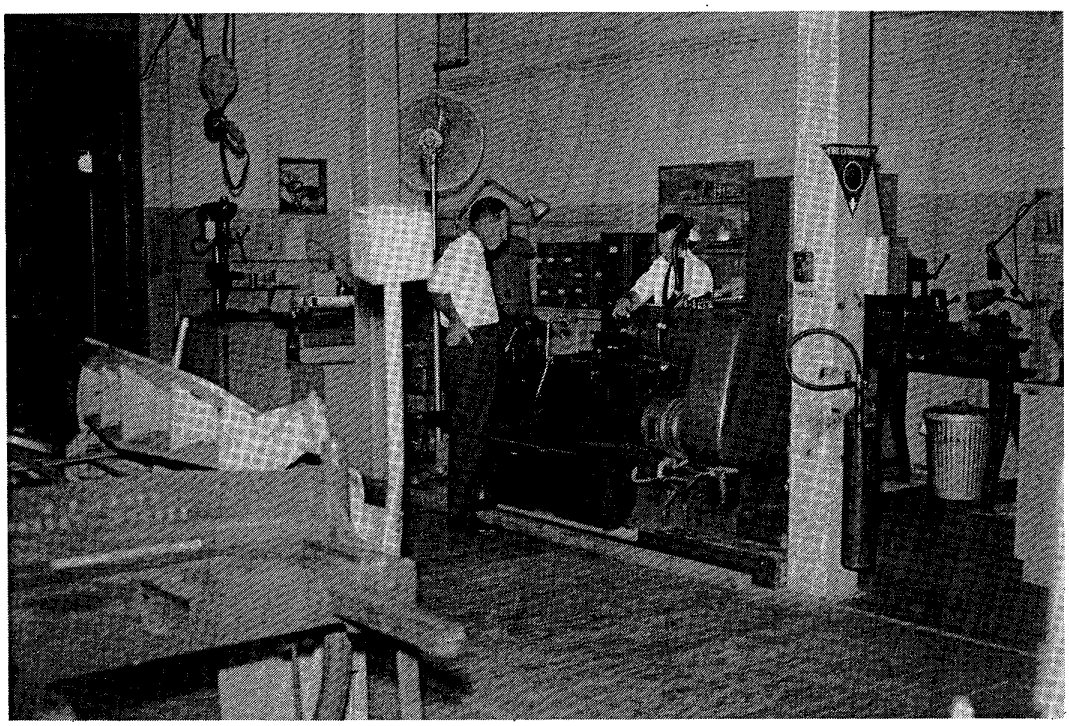


Diane Wall operating the Stantec Zebra, an early example of a digital computer.

The technology of Zebra was already outdated by the time it was commissioned and it never did much useful work because of its low reliability, but the laboratory did progressively update its computing equipment throughout its history. With the rapid reduction in costs and the increases in capabilities of digital computers, they came to play a major role in the location of positions at sea and in the collection of data as well as in the automation of exercise analysis. More complex computing was often done on high performance commercial machines and on CSIRO and university equipment.

Workshop

To support the Engineering Group in providing the specialised ocean engineering equipment needed for field work, a very capable mechanical workshop was built up over the years. The Laboratory's engineers specialised in the development of deep sea cables, winches , buoys and high pressure housings and seals. Considering the dangerous working environment at sea, the group had an enviable safety record.



The workshop on the lower floor of the Sayonara building. Eric Kaye is inspecting a job in a lathe.

SOCIAL AND SPORTING ACTIVITIES

RANRL Social Club

As many of the laboratory staff were away on field experiments for extended periods, there was a natural desire to involve the families of its members in social functions. Staff lived and worked together under cramped and frequently difficult conditions for periods of several weeks.

Family Day outings on the ship, when it was in Sydney, were often planned and became very popular with both the children and the adults. To see the reciprocating steam engines of the early ships was of considerable interest.

Family days on HMAS Kimbla

The first Social Committee was elected in the early sixties. A constitution for the club was drawn up and Amendment No. 1 was added in 1978. From that time on a committee was elected annually by the members. All staff that join RANRL automatically became members of the Social Club.

In late 1972, Bill Hunter, the Superintendent, suggested that the Social Club produce a Gazette to fight the breakdown in communications which may occur when an organisation like RANRL grows in size. This suggestion was implemented in January 1973 with the first publication of the RANRL SOCIAL CLUB GAZETTE under the club's President, Dick Sneesby. The Gazette also advertised social club events, relayed news of interest and introduced new employees. In March, 1973 the Gazette became known as the Rushcutter Rag and was produced under that name on a regular basis until

its further name change to HYDROPHONE to reflect the December 1987 DSTO reorganisation.

Since 1977, lunchtime BBQs have been held on a regular basis - 7 or 8 times a year, with visitors attending from other Naval and Government establishments. As well, the club organised an annual Christmas party, discount purchases, etc. In addition to these activities of the Social Club, there was an active Christian Fellowship and other social activities.

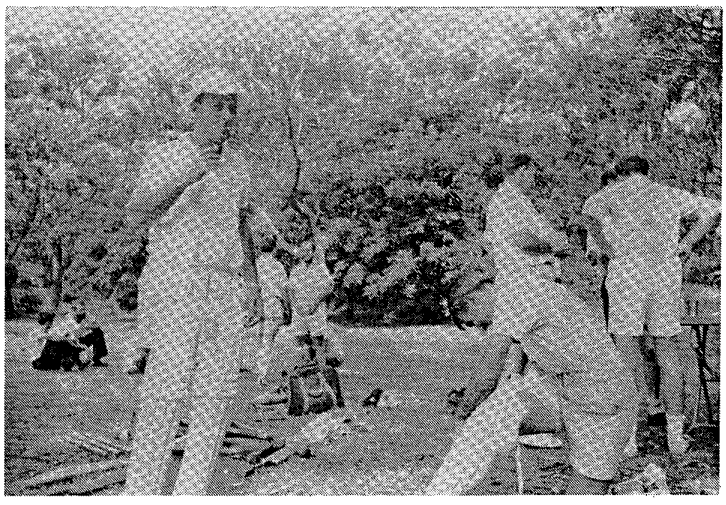
Sporting Achievements

In keeping with the interaction of work between RANEL and various Navy units it was decided to hold an annual cricket match against HMAS Kimbla.

The inaugural match was played at Trumper Park (Eastern Suburbs, Sydney) in 1961 and the RANEL team was captained by Cmdr Keatinge. HMAS Kimbla duly won this match. Festivities were held after the match (RANEL-Kimbla Dinner) but unfortunately at the time no permanent trophy had been procured. In keeping with tradition, a presentation of sorts was arranged. S/Lt. McGowan produced the first Cricket Match Trophy - in the form of a new "gozunder" (chamber pot) filled with champagne - to be drunk by the losing captain. Cmdr. Keatinge was, unfortunately, not in attendance, but was ably represented by Mr R. Wyber.

Some years later, Doug Cato designed a suitable shield and George Major (father-in-law of George Gardiner) carved and presented the shield to RANRL for future presentations to the winning team. Kimbla won the match in 1961, 65, 66, 73, 77 and 78 and RANEL/RANRL won the remainder. The last match was played in 1981.

After the commissioning of HMAS Cook in 1980, RANRL found another worthy opponent. The first cricket match between the two was held in 1982 and the winner was HMAS Cook. Cricket and golf were also played in 1981 against CSIRO (Marine Labs. and Oceanography - Cronulla). CSIRO won both events.



RANRL vs HMAS Kimbla cricket match.

Other sports have been held annually for many years, but unfortunately winners were not recorded until the late 1970's. The past winners in each sport were:

Golf

1963 B. Wild
1964 W. Hunter
1965 not played
1966 R. Wyber
1967 J. Johnson
1968 A. Kamenyitzky
1969 W. Hunter
1970 A. Kamenyitzky
1971-73 not played
1974 R. Ivory
1975-77 not played
1978 B. Wild
1979 G. Brown
1980 B. Wild
1981 R. Jones
1982 B. Wild

Pool

1978 J. Hibbert
1979 E. Vanderhoek
1980 M. Bushe
1981 A. Latham

Darts

1978 J. Hibbert
1979 A. Latham
1980 A. Latham
1981 A. Holland

Table Tennis

1978 B. Wild
1979 B. Wild
1980 M. Bushe
1981 L. Hamilton

Squash

1978 J. Manton
1979 A. Latham
1980 F. Bruzzone
1981 G. Lockey

RANRL entered a team in the first two City-to-Surf footraces. Team members were John Waller, Bill Hunter, Paul Nysen and Bob Smith. Other sports played occasionally were chess, volley ball and various card games.

CONCLUSIONS

The RAN Research Laboratory commenced in a period of global expansion of engineering and scientific research. The 1960's was an era when the United States applied technology to many problems on an unprecedented scale. Australia was swept along with the movement and the RAN Research Laboratory expanded to undertake more scientific projects in oceanography, sonar technology and operational analysis.

This evolution has allowed the Laboratory and its successors to provide over forty years of naval science to support the defence of the country. RANRL staff had a spirit which made a dynamic laboratory. They were justifiably proud of their achievements and many were sad when instructed to cease using the name "RANRL" on 1 December 1987.

ACKNOWLEDGMENTS

Jim Huggett did the bulk of the spade work in the early steps of this document including producing most of the information about the sites. (Now in file U490-1-19, part 1.) Ian Hagan, when Superintendent, asked Bill Hunter to take over editing the history. Help has come from too many people to name but special mention should be made of Jack Lonergan, Eric Kaye, Julian Hart and the Tonurists, Egon and Julie. The history of RANRL is the story of a fine body of dedicated people. We could not find photographs of them all, nor even mention them all by name. Production of the document was carried out by Jane Cleary and managed by Ian Jones.

Editor's Comment : This document was written in sections which overlapped somewhat. Attempts to make it less repetitive resulted in a disjointed story so I have elected for some repetition.

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Technical Documents

RANEL Reports 1956 - 1969

REPORTS	27
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RANRL Reports 1969 - 1987

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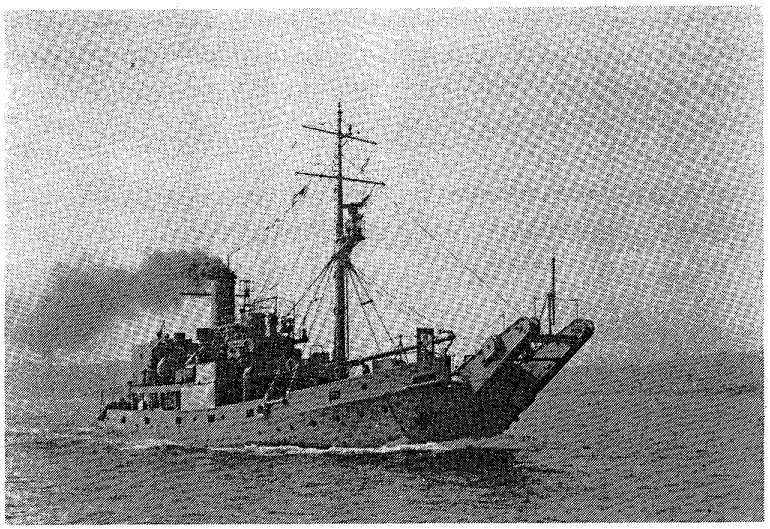
NAVAL OCEANOGRAPHIC SHIPS USED BY RANRL

The RAN's first involvement with oceanography came with the founding of RANEL.

HMAS Kookaburra, a wartime-built Boom Working Vessel, was modified for use as a research vessel and commissioned in this role on 11th May, 1956. Field work based on a passive detection project in the United Kingdom was commenced in the RAN in 1956. By 1958, limitations in this ship, particularly those of cable handling, endurance at sea and unsatisfactory laboratory accommodation, necessitated the use of another vessel.



HMAS Kookaburra

HMAS Barcoo - Australian River Class Frigate. After the war Barcoo underwent conversion to a survey vessel at Williamtown and served in this capacity until May, 1949, when she was laid up. In March, 1951, Barcoo re-entered service as an anti-submarine training ship, and reverted to survey duties in July, 1952. She was used in early RANRL trials prior to her paying off on 25th September, 1956.

HMAS Warrego - a Grimsby Class Sloop (later Frigate), was converted to a survey vessel after the war. After five survey seasons in South Australian waters, Warrego was reduced to reserve status in August, 1963 and sold in April, 1965.

HMAS Sprightly - originally a salvage tug, was sold on August 29, 1969. She is now known as RV Sprightly and was used extensively as an oceanographic research ship by the CSIRO. RANRL participated in a number of trials on board in conjunction with the CSIRO.

HMAS Kimbla - a newer and larger Boom Working Ship was converted to a trials vessel in 1959, thus replacing HMAS Kookaburra. From 1959 to 1984 she was employed as an oceanographic research ship, working in conjunction with RANRL and other scientific establishments.

HMAS Diamantina - a River Class Frigate, served mainly in the Pacific region until her conversion to a survey ship after the war. She had been engaged on military and civilian oceanographic research including work for the CSIRO, universities and museums until her decommissioning in November, 1979. During the late 1950's and 60's, another converted River Class Frigate, HMAS Gascoyne, was used for oceanographic research purposes largely by the CSIRO and the Bureau of Mineral Research.

HMAS Cook was commissioned on 28th October 1980, as the first ship in the RAN specifically designed for oceanographic duties. The ship was 316 feet long, displaced 2 600 tonnes and had a speed of about 16 knots. Accommodation for scientific crew was 13. The ship was fitted with a very sophisticated narrow beam echo sounder, one of the first of its kind in the world to be built and the third of its kind to go into service. Its heart was a computer which controlled 16 narrow beams radiated at different angles from the hull and then compensated to give the true depth of water and displacement from the line of advance of all returning signals. The ship was also fitted with a Hewlett Packard 1000 computer into which were fed wet and dry air temperature, sea surface temperature from three sources, radiation intensity throughout the entire frequency spectrum, solar radiation intensity, wind speed and direction, ship gyro course, speed through the water by electromagnetic log, water temperature depth profiles from expendable bathythermographs, sound velocity, conductivity, temperature, oxygen content and depth information from which the computer calculated salinity, wave height and period information transmitted by wave rider buoys, depth to the bottom from both the narrow beam and conventional echo sounders, gravitational force, ship's roll and pitch, and time. Additionally, meteorological data such as cloud and type, precipitation, etc, could be entered manually as could the ship's positional data from either visual or radar fixing mini-ranger short range navigation system, Argo medium range navigation system, or Satnav satellite navigation system. The ship carried the Radio Sonde meteorological data system, a high definition Simrad sonar set for bottom profiles, a water sampling capability, the ability to conduct acoustic/seismic surveys and a core sampling facility. The ship was fitted with several laboratories and dark-room facilities.

HMAS Cook

The ship was used in deployments of up to 10 weeks duration by RANRL, with some time for the CSIRO and universities in areas such as the SW Pacific, Indian Ocean, Tasman Sea, Bass Strait and the Southern Ocean.

HMAS Cook was decommissioned in October 1990.

RAN and RN submarines have also played a role in carrying out oceanographic research for RANRL.

Navy and Airforce aircraft frequently dropped the explosive charges used as sound sources in long range acoustic propagation measurements.

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RAY GOSSAGE AWARD

Background
Ray Gossage was a Senior Principal Scientific Officer in the Admiralty and was seconded to Navy Office from 1955 to 1959 as the first Scientific Adviser to the Naval Board which, in those days, was located in Melbourne. When he left he presented RANEL with a trophy which he called an Alphabetical trophy for the

"**M**ost **N**otable **O**r **P**ertinent **Q**uestion **R**elating to **S**cience and **T**echnology".

Gossage introduced a whimsical twist by giving us a trophy which was a Victorian Hot Water Jug on the grounds that RANEL got him into plenty of hot water in Victoria. (Navy Office was in Melbourne at that time.)

Ray Gossage displays the Victorian Hot Water Jug.

The twist continued when an early recipient - a Scientific Officer called Bill Hunter presented the award to Mr Len Rippon who was stated to be an

> "**A**ble **B**odied **C**haracter, **D**estined **E**asily **F**or **G**reat **H**eights, **I** **J**ust **K**now **L**enny's **M**ost **N**otable **O**r **P**ertinent **Q**uestion **R**elegating **S**cience **T**o **U**nknown **V**alleys **W**ill be ... How Do I Complete The **XYZ**?"

The twist spiralled further and the trophy for some years was awarded to someone who had made some notable gaffe during the year hence the change from "relating" to "relegating" in the citation of the trophy.

In 1977, Bill Hunter decided that the Gossage twist should complete the full circle and that the trophy would again reflect Gossage's original intention of being a serious award for merit.

Nature of the Award
The Ray Gossage Trophy was presented by the Superintendent or his representative at the Annual Christmas celebration and it consisted of two parts:

(a) Victorian Hot Water Jug - to be retained for one year

(b) RANRL plaque - to be retained by the recipient and engraved as follows:

Awarded to (name)
For Meritorious Performance
of Duties - December 19..

The award was made for some identifiable achievement during the preceding year.

An early recipient, Mr Len Rippon, receives the award.

The achievement was judged in relation to the expectation for the level of officer concerned. A greater achievement would be required from more senior officers to be judged equal in merit with junior staff. Thus the intention was that the award should be potentially available to all staff.

Technique for Nominating
Nominations were made in writing to the Director at any time during the year, with a brief description of the reason for the nomination. A reminder memo calling for nominations was circulated just before nominations closed. In addition Group Heads made nominations at the December Management Committee Meeting. The Director did not nominate anyone, as he might have had to make a casting vote in the final choice.

The notification calling for nominations stated "This is an award for merit. To have been nominated means that one has recognition by one's peers. It is not a Nobel Prize nor a Brownlow Medal so some degree of error in the final choice is acceptable - no one should feel disappointed for not being chosen, but all who have been nominated should feel proud."

KNOWN WINNERS OF THE RAY GOSSAGE AWARD

1960	J. Jackson
1961	W. Hunter
1962	L. Rippon
1963	not awarded
1964	not awarded
1965	R. Long
1966	F.J. Johnson
1967	not awarded
1968	F.J. Johnson
1969	not awarded
1970	not awarded
1971	not awarded
1972	E. Kaye
1973	R.B. Jones
1974	I.S.F. Jones
1975	W.F. Hunter
1976	not awarded
1977	E. Vanags
1978	G. Wurm
1979	M. Frost
1980	R.B. Jones
1981	E.J. Huggett
1982	J. Uusioja
1983	C.L. Charnas
1984	A.R. Collins
1985	M.S. Craig
1986	R.J. Wyber/G.C. Speechley
1987	not awarded

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PLAQUES AND PRESENTATIONS HELD BY RANRL

RUSHCUTTER : denotes the early Naval occupation of the site.

RANRL : the then insignia.

AUWE : for Joint Trials in the Far East, Autumn 1966.

NUWC/RANRL : FASOR 3 trials, 1969.

ARMED FORCES FOOD SCIENCE ESTABLISHMENT

ENGINEERING DEVELOPMENT ESTABLISHMENT (October 1977)

ROYAL NEW ZEALAND NAVY

ADMIRALTY MARINE TECHNOLOGY ESTABLISHMENT

PAINTING Sea-scape titled "Song of the Surf" presented by I. Gatenby on his departure from Australia, 1960.

CARVING (in wood) OF PROFILE OF HMAS Kimbla by Mr George Major at the request of Mr Alan Thompson.

GOLF TROPHIES - The first trophy was donated by Alan Thompson and the second one by Bill Hunter.

THE MONSEA TROPHY - This is a large wooden spoon and fork purchased by RANRL participants in the joint Anglo-Australian acoustic survey "Project Monsea" in 1966, as a memento. The spoon and fork are of Philippine manufacture and were bought in the Post Exchange of the American Naval Base at Subic Bay, Philippine Islands.
The spoon, designated "part A" was awarded annually at the RANRL Christmas Party for stirring activities or experiences. The first award was made to M.D. Frost for the stirring experience of being in an airliner when all engines failed. (Boeing 707 in the U.S.A.).
The fork was designated "part B" and was first awarded to D. Steward for "digging out". At the time RANTAU was being formed and Don was (jocularly) accused of pirating RANRL staff for his new empire.
Part B is now in the possession of the family of the late Robert Wyber, a former Principal Scientist and the first civilian Superintendent of RANRL.
Part A has not been awarded for some years, but is prominently displayed at RANRL.

CLOCK BOUGHT IN MEMORY OF BOB WYBER

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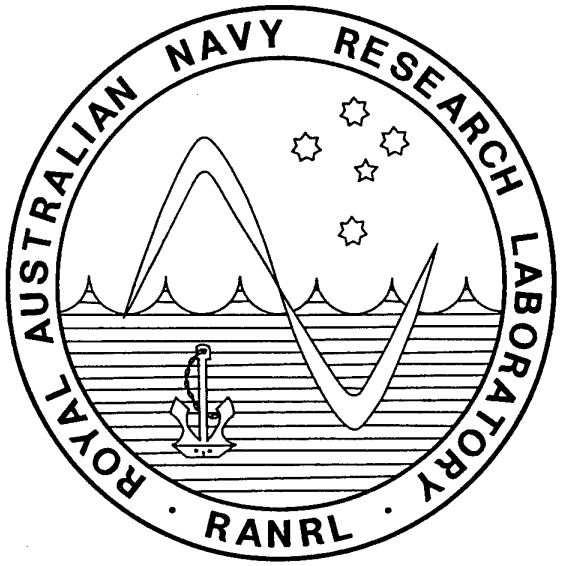
RANRL LOGO

During the 1960's and early 70's, several suggestions and examples were submitted for badge or crest to symbolise RANRL's identity. The crest finally selected was submitted by Dr D.H. Cato. The sine waves in the crest are symbolic of science. The ray paths for acoustic propagation under the ocean surface and for radio propagation over the surface are shown, symbolising RANRL's concern both above and below the surface.



The RANRL logo designed by Doug Cato.

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LIST OF ACRONYMS

AAW	Anti Air Warfare
ADSS	Australian Defence Scientific Service
AODC	Australian Oceanographic Data Centre
ARL	Aeronautical Research Laboratory
ASUAT	Anti Submarine Universal Attack Trainer
ASN	Australian Steam Navigation Company
ASW	Anti Submarine Warfare
BUMP	Bass Upper Mantle Project
COOP	Craft of Opportunity
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DDG	Guided Missile Destroyer
DISB	Defence Information Services Branch
DRANRL	Director RANRL
DSL	Defence Standards Laboratory (Melbourne)
DSS	Director of Scientific Services
DSTO	Defence Science and Technology Organisation
FFG	Guided Missile Frigate
GLEX	General List Executive Officer
HDML	Harbour Defence Motor Launch
HMUDE	Her Majesty's Underwater Detection Establishment
JASIN	Joint Air Sea Interaction experiment
MCM	Mine Countermeasures
HMCS	Her Majesty's Colonial Ship
MoD(N)	Ministry of Defence (Navy)
MSL	Munitions Supply Laboratory
OPEVAL	Operational Evaluation
OR	Operations Research
RAAF	Royal Australian Air Force
RAN	Royal Australian Navy
RANEL	RAN Experimental Laboratory
RANRL	RAN Research Laboratory
RANTAU	RAN Trials and Assessing Unit
RATEL	RANRL Automatic Telemetry Link
REVY	Royal Edward Victualling Yard
RN	Royal Navy
RNSS	Royal Naval Scientific Service
SANB	Scientific Adviser to the Naval Board
SEATO	South East Asia Treaty Organisation
SLT	Services Laboratories and Trials
SNSS	Superintendent Naval Scientific Services
SO	Scientific Officer
TTCP	The Technical Cooperation Panel
UHF	Ultra High Frequency
USN	United States Navy
WRANS	Women's Royal Australian Naval Service
WSRL	Weapons Systems Research Laboratory

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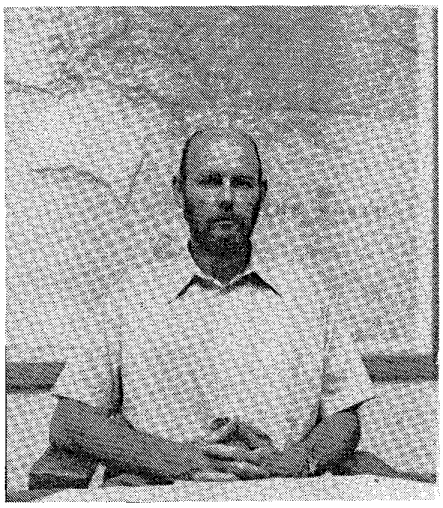
ABOUT THE EDITOR



Dr Bill Hunter devoted his professional life to science, most of it in the development of the RAN Research Laboratory.

William Francis Hunter graduated from the University of Western Australia in 1953 and joined the Long Range Weapons Establishment in Salisbury, SA, a part of the Commonwealth Government Department of Supply. His first investigations concentrated on Monte Bello and Maralinga nuclear tests.

After joining the Department of Navy as a scientific officer at RAN Experimental Laboratory in Sydney, NSW, he gained experience with an eight month secondment to the British Underwater Detection Establishment in Portland, followed by sixteen months at the Admiralty Research Laboratory at Teddington.

Bill Hunter returned to Sydney in 1959 to join the acoustic analysis group at RANEL and, in 1960, he became head of that group. In 1963, Bill was promoted to senior scientific officer, and in 1964, he presented scientific papers in the USA and visited naval establishments in the UK and Singapore.

From 1965 to 1967, Bill Hunter was at the Imperial College of Science and Technology in London on the first Naval Defence Act scholarship. During this time, Bill attended several conferences in Europe and Scandinavia. In 1967, Bill was awarded a PhD in underwater acoustics by the University of London. He was the first Australian to obtain a doctorate in underwater acoustics.

In 1967, he returned to Sydney to RANEL, and in 1968 he presented a scientific paper at the International Congress on Acoustics in Tokyo. In 1970, Bill Hunter succeeded Bob Wyber as Superintendent of RANRL. In this position, he guided the laboratory through its transition from an experimental laboratory to an organisation contributing both to international science and to policy for the RAN.

From 1983 to 1986, Bill was transferred to the position of Counsellor, Defence Science at the Australian embassy in Washington DC, where he represented the Chief Defence Scientist for all of DSTO. In 1986, he returned to Sydney to be Superintendent Maritime Systems Division - a division of the DSTO Weapons Systems Research Laboratory (WSRL).

In June, 1988, he retired from the Defence Department after having presided over the last 17 years of the RAN Research Laboratory.

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